FOOD MANUFACTURE

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FOOD MANUFACTURE

Incorporating Canning, Packing and Preserving.

VOLUME - - - XV

NUMBER - - - 11

NOVEMBER 1, 1940

MILK PRODUCTS NUMBER

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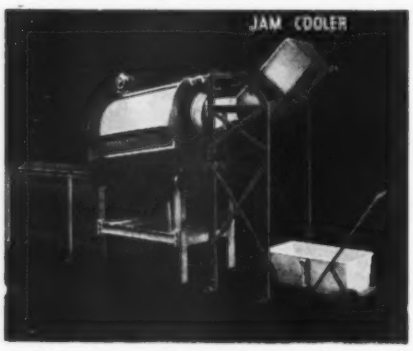

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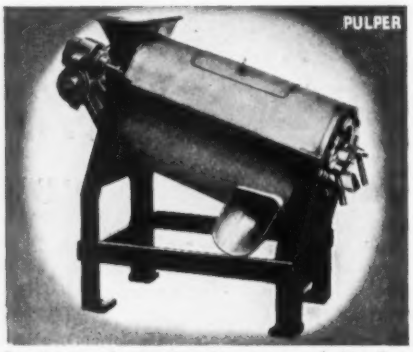

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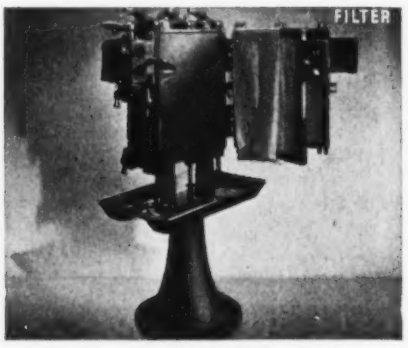

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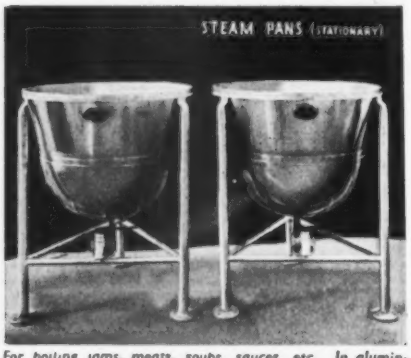

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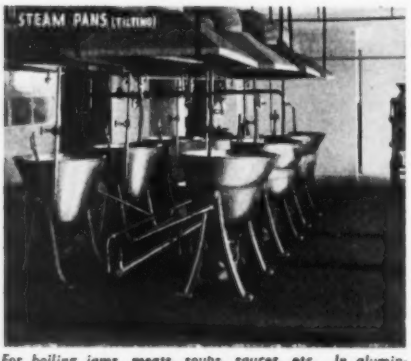

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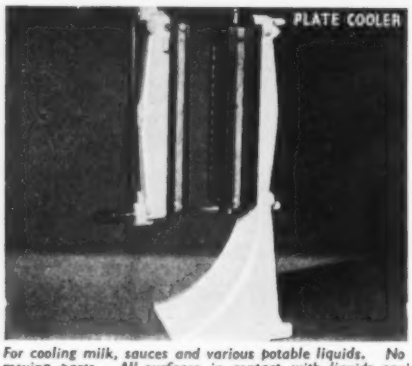

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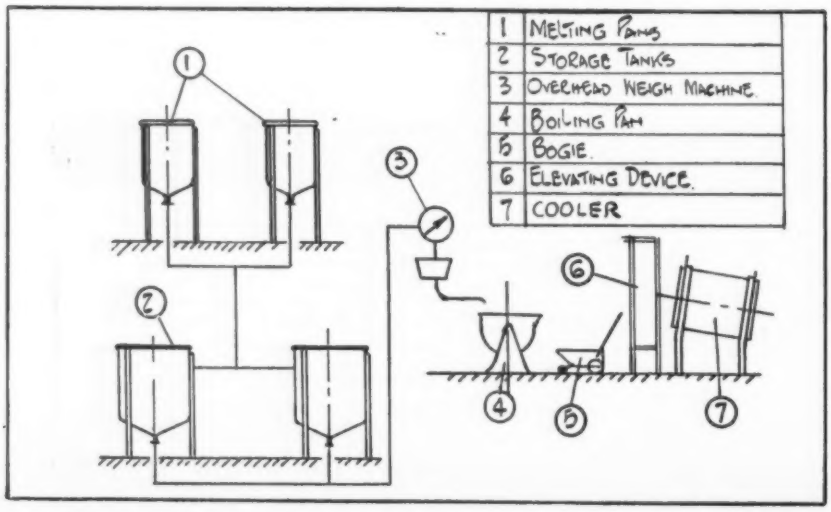

Facing first page of Editorial

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FOOD MANUFACTURE

Vol. XV, No. 11 November 1, 1940

Food and Factory Output

THIS WAR is causing a great deal of attention to be focussed on nutritional problems, and the increased consumption of food caused by the intensity of war effort is discussed in a book called *Nutrition and the War* by Dr. Geoffrey Bourne. The author believes that restrictions of food will prove disastrous. "A man doing four hours' overtime", he states, "needs an addition of 540 calories to his ordinary diet", and goes on to ask, "If such a man is already living at the limit of his income, where are the extra calories to come from? If he cannot buy the necessary food he can only obtain them by burning up his own tissues, and this means that sooner or later he will break down". He suggests that the danger can be avoided if men working in industry are supplied with a glass of milk, two or three slices of bread and butter and cheese, together with some fruit if possible. He also thinks that the cost of this should be borne by the firm out of excess profits. Failing that, he suggests that the Government should see to it as a piece of preventive medicine.

Why not Apple Juice?

Heavy duties have hit the heavy beers. The last additional 2d. per pint (for the duty is based on gravity) has led to a restricted demand for the higher gravity beers. Mild beer is now drunk freely in the "saloon bar." Draught cider, however, appears to be gaining most ground, owing to its freedom from duty. Mineral waters, apart from "soda," do not appear to be making similar progress. "In some districts grapefruit sales are up on licensed premises but not to any great extent, and although hop bitters are showing signs of revival, nothing approaching the demand which existed during the last war has yet manifested itself," says *The Mineral Water Trade Journal*. Although this looks as if there is not much demand for substitutes for beer, as there was in the last war, we suggest that this may be the time for the popularisation of canned or bottled *pure* apple juice, which has many properties besides its sweetness to recommend it.

Quality Control in Canning

We agree with Mr. F. Hirst, Director of the Fruit and Vegetable Research Station, Campden, when he deplores the discontinuance of the National Mark Scheme since the beginning of the war if it means that it is going to affect the quality of commercial canned fruits and vegetables. He states in his introduction to the Annual Report of the Station for 1939 that it would be to the ultimate good of the industry that there should be some means of quality control.

In the words of Professor Bernard E. Proctor, in his article, "Quality Control," published in last month's FOOD MANUFACTURE, "Do such things as quality control pay? I believe those in the plants where real quality control is exercised will answer with an emphatic Yes," is summed up the American view. Professor Proctor was alluding to quality control within the industry itself, but however and whenever it is applied its value cannot be called into question. Probably a good proportion of British canners recognise this. That there are some who do not is suggested by Mr. Hirst's remarks.

Determination of Lead in Vinegar

The quantitative determination of lead in vinegar by spectrographic methods is described in a paper by Charles W. Schroeder and Hermann C. Lythgoe, presented at a recent meeting of the Division of Agricultural and Food Chemistry of the American Chemical Society.

The lead content of twenty samples of market vinegar was determined as follows: Evaporate 25 c.c. of vinegar to dryness in a platinum dish on the steam bath. Dissolve the residue in 0·5 c.c. of concentrated HCl containing 1 mg. of bismuth per c.c. Divide the well-mixed solution of the residue equally among three cupped graphite electrodes which have been treated with a drop of kerosene, and dry at 100° C. in an oven. All apparatus and reagents must be lead-free.

The samples were then burned completely in an arc of 220 volts and 9 amperes and the lead determined by the internal standard method, using a rotating log sector before the slit and comparing the lengths of the lines of lead at 2833 Å. and bismuth at 2898 Å. The lengths of the three lines from the divided sample were averaged before plotting.

In a series of sixteen analyses of vinegar containing known added amounts of lead, in the range from 0·08 to 1·2 p.p.m., the average error was 8 per cent. and the maximum error 25 per cent.

Twenty-two samples of market vinegar contained amounts of lead varying from none up to 1·2 p.p.m. with an average of 0·51 p.p.m.

Detection of Sodium Alginate in Dairy Products

The thickening agent known as sodium alginate may be detected in milk, cream, cream cheese, and ice-cream by the following method: The sample is boiled with 6N HCl, and the residue washed first with 75 per cent. alcohol and then with ether until free of soluble matter. The residue is then dissolved as far as possible in dilute NaOH and the solution filtered. The gum is precipitated from the filtrate by addition of an equal volume of alcohol and washed free of soluble matter with 75 per cent. alcohol. The purified dried residue from the sodium alginate is then dissolved in 0·15 c.c. of tenth normal NaOH, and 1 c.c. of concentrated sulphuric acid saturated with $Fe_2(SO_4)_3$ is added. In the presence of sodium alginate, a purple colour develops after standing. 0·1 mg. of residue is sufficient to give the colour test.

No interference with the test is given by starch, gelatin, Irish moss, agar, gum tragacanth, India gum, locust bean gum, gum arabic, or formaldehyde.

According to Charles W. Schroeder and Phileas A. Racicot (*loc. cit.*) the test will easily detect 0·2 per cent. of the commercial sodium alginate product known as "Dariloid," which will also give a test for dextrin, a constituent of the commercial product.

The Eel Industry

The food industry does not seem to have made very speedy response to the Government's ideas to revive our eel fisheries during war-time. Eels exceed salmon in calorific value and fat content, and already could be made available in industrial quantities from East Anglia, the Lincolnshire dykes, the

Cheshire meres and the Severn valley. A nation-wide industry such as the Government outlined would require a better control of river pollution and the distribution of elvers to those waters not very well populated at present. We lack sufficient big muddy estuaries to practise eel farming as carried out in Italy, where the eels are trapped in hurdle enclosures, fattened up there and caught in the proper eel traps and buckets. The eels have their heads chopped off and the bodies cut into 4½-inch lengths, each alternate length severed through so that two can be folded back together. They are then roasted on spits in open hearths (during which process a considerable amount of oil is obtained) and later cooled, salted and packed. No other freshwater fish (beyond trout and salmon, already well commercialised) is of industrial importance, and the methods of breeding or "farming" carp and roach which have been perfected in recent years are too slow to have any war-time commercial possibilities.

Milk or Rabbits?

At last something is going to be done about the rabbit pest. County War Agricultural Committees have been asked by the Minister of Agriculture to prepare for an intensive campaign against rabbits this coming autumn. For the rabbit is a pest with no redeeming features. Its meat is of low nutritional value and five rabbits will eat as much as one sheep. Where they are abundant, they make corn-growing impossible in the fields near their burys; and they do almost as much harm to grass, although it is less spectacular. Estimates of the damage they do each year vary between £30,000,000 and £60,000,000.

The County Committees have powers, under the Defence Regulations, to serve orders for the destruction of rabbits. If the order is not complied with, the Committees may carry out the destruction themselves and recover the cost from the person in default.

But farmers will be acting in their own interest, as well as the nation's, if they set to work on their own to rid their farms of these pests that are agriculture's war-time Fifth Column. In many cases this winter, when so much food for the cows will have to be grown at home, it will be a question of milk or rabbits, and there is no doubt as to which pays the better, or which the country needs.

If they are in any doubt as to the best methods to use, they should ask the advice of their County War Agricultural Committee. If skilled labour and equipment are a difficulty, again the County Committee can probably help them.

Lipolysis in Raw Milk

That the homogenisation of raw milk considerably increases the lipolysis of the milk fat is now generally accepted. In a study of the influence of different temperatures of homogenisation on the rate and extent to which lipolysis occurs, I. A. Gould (*Ind. and Eng. Chem.*, 32, **6**, 876) describes trials in which the following temperatures of homogenisation were used: 70°, 105°, 115°, 125°, 135°, and 145° F.

The milk, immediately upon reaching the proper temperature, was homogenised at 1,500 lb. per sq. in. and promptly cooled to 40° F. Each lot was then divided into two portions. One portion was immediately pasteurised at 145° to 150° F. for 30 minutes to prevent any further lipolytic changes; the other portion was stored at 35° to 40° F. for 72 hours and then pasteurised. Following pasteurisation, the milk was separated and the cream cooled. The separated and purified fat from the cream was titrated for free fatty acids.

The maximum amount of fat splitting occurred when the homogenisation temperature was 105°, although 115° F. gave results practically as great. The same trend existed both in the 0-hour and the 72-hour samples. Homogenising at 125° F. also gave a high degree of fat splitting, whereas a marked decrease in lipolysis occurred at 135° F. However, even this temperature gave an appreciable increase of fat acidity during the 72-hour storage period; appreciable lipase activity was indicated as well as the fact that this temperature is not sufficient to inactivate, although it does inhibit, the enzyme. Even the milk which was homogenised at 145° F. underwent a certain amount of lipolysis.

Edible Oil Refining

The bleaching and purification of oils, fats and fatty acids by a small quantity of metal in a finely powdered state is the subject of a Holland patent application. The oil is first dried and the powdered oxidising or reducing agent thoroughly stirred into the oil. Stirring is continued until the colour ceases to change, after which a small amount of a concentrated inorganic acid such as hydrochloric or sulphuric acid is stirred in. Stirring is then continued as long as the condition of the oil seems to require. This is usually from one to four hours. The oil is then moderately heated, a filter aid is added and the oil filtered. The filtrate is a clear, pale oil in which non-fatty impurities have been removed while the fatty acids have been retained.

Antineuritic Value of Parboiled Rice

The fact that undermilled rice deteriorates rapidly on storage, developing an unpleasant odour and taste, has made it much less popular than the nutritionally inferior polished grain, according to I. A. Simpson, writing in *Bull. No.* 4, 1939, the Institute of Medical Research, Kuala Lumpur. Parboiled rice is in a different position. If properly prepared, it can be almost as white and palatable as polished rice. Unfortunately, however, the commercial article is frequently of bad colour and may have an objectionable flavour. These drawbacks are largely due to incorrect methods of preliminary soaking, which encourage the development of anaerobic bacteria. On the other hand, the steaming process is likely to sterilise the grain and, provided that the final drying is sufficient, there is no reason why parboiled rice should not be capable of storage for long periods without serious deterioration.

The feeding experiments on rats, described in detail in the report, show that the antineuritic values of parboiled rice, whether overmilled or undermilled, compare very favourably with those of undermilled raw rice.

Antiscorbutic Values of Fruits and Vegetables

We have received a reprint of the interesting article by Mamie Olliver, published in the *Lancet*, August 17, in which the antiscorbutic value of fruits and vegetables as normally consumed is considered and the outstanding factors influencing this value are reviewed.

The author first considers household cooking and its influence upon vitamin C, and has come to the conclusion that its destruction is sometimes negligible when care is taken. A useful table shows the amount of ascorbic acid in raw, cooked, and canned vegetables and fruit. Another table shows the effect of sodium bicarbonate and sodium carbonate on the ascorbic acid content of cooked greens. The figures show that the effect of soda is negligible compared with the variations due to different methods or times of cooking, and especially compared with the loss resulting from extraction.

Controlled tests have shown that fruits and vegetables after commercial canning have the same antiscorbutic values as similar fruits and vegetables cooked by careful household methods. It is specially notable that extended storage of the can has little effect on the stability of the vitamin. The heat treatment of jam boiling does not affect the ascorbic acid content, and typical results showing this are tabulated.

Still another table shows the comparative costs of ascorbic acid from different sources, although many of these costs must be very materially revised. Cabbage, canned black currants, potatoes and brussels sprouts are probably still the cheapest form of ascorbic acid, and oranges the most handy and not unduly expensive concentrated source.

Artificial Maturing of Wheat

The modifying effect of small quantities of ethylene on the changes commonly associated with the ripening of certain natural products has been appreciated for a number of years. The result appears first to have been described by Denny in a paper, "Effect of Ethylene on the Respiration of Lemons". He exposed mature green lemons to dilute concentrations of ethylene and found that this caused a more active evolution of carbon dioxide from the fruit and the rapid appearance of the yellow colour of the skin. Later, Chace and Church found a similar effect on oranges, accompanied by the disappearance of free acid and increase in sugar. It has recently been observed that apples give off ethylene during the ripening process, and this influences any neighbouring green fruit, and hastens ripening.

The effect is not confined to fruit. Chace and Sorber have described its influence on walnuts, and now Balls and Hale have tried it on wheat. In the harvesting of wheat two methods are in common use; the older method where wheat is cut and allowed to remain in stook in the field and the newer combine methods in which wheat is threshed at the time of cutting and thereafter stored in bins. The after-ripening—sometimes called sweating—does less damage in the former method, and Balls and Hale have sought to reproduce the biological changes that occur in the stook by exposing wheat in the bins to small amounts of ethylene. These results appear to be promising, and a necessarily brief experiment on freshly harvested combine wheat has shown that small doses of ethylene are able to mature the wheat very quickly in the sense that it becomes suitable for bread making. There seem to be considerable commercial possibilities here.

Vegetables for Pickles

There is now an assured market for the vegetables grown for pickling that formerly came here from abroad. The pickle manufacturers want the vegetables, will pay fair prices for them and will make contracts if required. They will go even further and advise the farmers on growing the crops they need.

The vegetables chiefly in demand are cauliflowers, broccoli, red cabbage, ridge cucumbers, onions, gherkins and shallots. A round, white-fleshed onion is the type required, and the bulb should go through a 1¼-inch riddle. Seed should, therefore, be sown thickly and thinning not carried out. Silver Skins, White Spanish and Up-to-date are suitable types. Red cabbages are easily grown. They should have tight, close heads, and Stonehead and The Lydiate are good varieties.

Cauliflowers for pickling are needed in considerable quantities. Here again tight, close heads and hard curds are required. Danish Giant serves the purpose well, with Veitch's Autumn Giant for later sowing. Gherkins and ridge cucumbers are already being successfully grown, especially in the South, and there is a moderate demand for beetroot and shallots.

Is Goat's Milk Safe?

In spite of the efforts of the British Goat Society the goat has in the past played but a humble part in the domestic economy of this country, according to the *British Medical Journal*. Prejudice dies hard, and the widespread belief that goats milk necessarily has an unpleasant taste has deterred many people from using it. The goat, however, has many advantages over the cow, particularly in war-time. It is the ideal animal for the small-property holder. It is not dependent on imported foodstuffs, as cows are; it can scrape an existence from patches of grass and herbage that are not worth cutting or cultivating; it is inexpensive to maintain; and, properly looked after, it gives a good yield of high-quality milk. In the minds of medical men the idea of the goat is closely linked to that of undulant fever. In Malta, Southern Italy, South-Eastern France, and the Mediterranean littoral generally, infection of goats with *Brucella melitensis* is common, and consumption of this milk in the raw state is accompanied by a serious risk of undulant fever. In Great Britain, however, in spite of several direct investigations, neither this organism nor *Br. abortus* has ever yet been isolated from goats. Unlike cattle, about 40 per cent. of which are infected with tuberculosis, the goat is very refractory in nature to this disease. Being free from organisms of both the *Brucella* and the tubercle groups, goats' milk can be recommended without hesitation for human consumption in the raw state.

Humour in the Ministry

Under the caption "Rats Attempt Reprisals," the Ministry of Agriculture, in a paragraph included in their news service has launched out into humour thus: "The Ministry has declared a Blitzkrieg on rats that is just due to begin. On a recent morning, however, on the very floor where the campaign had been planned, unmistakable traces were found of an attempted counter-stroke by the enemy. Invasion had occurred.

"After a hasty conference at which some were in favour of calling in the aid of the Office of Works, it was decided to resist the enemy with local resources. A plan has been made, and it is hoped that the invader will walk into the trap which the commander of the Ministry's forces, their Rat Officer, has laid. Should this fail, it is darkly hinted in Whitehall that Queensberry rules may be abandoned and poison employed."

Metaphors a bit mixed, but we mustn't look jokes in the mouth these days.

Government Livestock Policy

The Government have recently found it necessary to limit acceptances of fat cattle and sheep at collecting centres, states a joint announcement by the Agricultural Departments and the Ministry of Food.

The seasonal ranges of prices of fat cattle between November, 1940, and June, 1941, and fat sheep from September, 1940, to April, 1941, are wider than in peace-time, and have been designed to give an incentive to the winter feeding of beef cattle and sheep, since the Government wish to secure a steady flow of marketings through the coming months.

Farmers are advised, in the interests of herd preservation, of land fertility, and of future food supply, to retain specified classes of stock, and it is suggested that if farmers give full co-operation in withholding these classes of stock it will not be necessary in the national interests to restrict the number accepted for slaughter.

It is appreciated that the above policy depends on adequate supplies of feeding stuffs being available, and priority will be given to milk production in the allocation of supplies. Feeders of cattle and sheep during the coming winter will be provided with 60 per cent. of the supplies of oilcake which they purchased for such stock in the winter and spring of 1938-1939. It is hoped that with increased supplies of home-grown grain and of fodder crops now available on farms, and with more economical feeding, farmers generally should be able to maintain their normal head of cattle and sheep and to market them regularly through the coming months in accordance with the national requirements.

Another Vitamin

The discovery of another vitamin, known as vitamin M, which protects against a condition in which there is a reduction of red and white blood cells in the body, was announced in a report prepared by Dr. Paul L. Day of the University of Arkansas and presented before the research section of the National Live Stock and Meat Board's annual meeting held in Chicago.

Liver is the source of this vitamin, according to Dr. Day. He is now at work to determine the value of other meats in this respect.

The Manor House (containing laboratories and offices) and the Stenhouse Williams Memorial Library.

THE NATIONAL INSTITUTE FOR RESEARCH IN DAIRYING

T. CROSBIE-WALSH, F.I.C.

DAIRY RESEARCH has been defined by Sir William Dampier in the following terms: "A study by scientific methods of the dairy industry and its products, and of the fundamental scientific principles underlying its operations." He amplifies his definition thus: "The dairy industry begins with the dairy farm, including the growth of fodder, both grass and arable crops, the breeding, management and feeding of the dairy herd, the production of milk, the operation of milking and the handling of milk, farm processes for the conversion of milk into dairy products such as butter or cheese and the storage and marketing of milk and these products.

"Secondly, come the problems of the dealers and manufacturers who collect milk, transport and distribute it to the retailers and convert surplus milk into dairy products by large-scale processes. Thirdly, there is the retail trade and the delivery of milk to the consumer. Fourthly, we have the problems of the nutritive value of milk and its products in different forms, together with the medical and public health questions which are involved. Moreover, to obtain a complete survey, most of these problems need studying from two or more different aspects—agricultural, chemical and physical, physiological, bacteriological, statistical, economic and financial."

These wide terms of reference cover almost entirely the work of the Institute, although only a staff of enormous dimensions could provide specialists in every branch of knowledge required to meet all types of dairy problems. Thus it is that when the required knowledge has not been available at the Institute collaboration with specialist investigators in other Universities and Institutions has been sought.

At its foundation in 1912, the Institute formed a department of the Faculty of Agriculture and Horticulture of University College, Reading. In 1921, however, when the purchase of the Shinfield Manor Estate for the purposes of the Institute was completed, it was considered desirable to grant to the Institute a measure of autonomy, and the Council of the College executed a Deed of Trust in relation to the property and funds of the Institute. By the terms of this deed, all such property and funds, present and future, are held in trust for the use of the Institute, and all general powers of management and control of the Institute are delegated to a Board, of which the Earl of Iveagh is Chairman, and on which are represented:

The Ministry of Agriculture and Fisheries. The Ministry of Health. The Council of the University of Reading. The Royal Agricultural Society of England. The British Dairy Farmers' Association. The National Farmers' Union. The Subscribers to the Trust Funds of the Institute. Persons engaged or interested in the industries or problems concerned with milk or milk products.

Organisation of the Institute

The work of the Institute is organised in four main departments, Dairy Husbandry, Chemistry, Bacteriology, and Physiology and Biochemistry, each under the direction of a responsible head, and two smaller sections, the Experimental Dairy and the Library. Co-ordination of the work within the Institute is secured through the agency of a Professional (Staff) Committee, consisting of the Director of the Institute, who is Chairman of the Committee, the Heads of Departments, the Dean of the Faculty of Agriculture and Horticulture of the University of Reading and certain elected members.

Close touch with the dairy industry in all its branches, production, processing and manufacture, and distribution, is the keynote of the Institute, and members of its staff are in touch in other ways not only with organised producers and manufacturers but directly with numerous individual farms and farmers, butter and cheese makers and milk processing and distributing firms and their staffs. The Institute has an advisory department, which houses the Southern Provincial Adviser on Dairy Bacteriology under the Ministry of Agriculture's Advisory Scheme and which affords very close contact with the industry, particularly with milk producers' problems.

Dairy Husbandry Department

(i) **The Farm and its Crops.**—The farm covers an area of 350 acres, of which 160 are arable, 150 acres grass and the remainder occupied by woods, gardens, allotments and buildings. Its main object is the maintenance of a dairy herd, and the cropping of the arable and pasture land is directed mainly towards this end. From time to time, however, experiments have been made on varieties of mangels, silage crops and wastage in the silo, nitrogenous manuring and intensive stocking of pasture land and the value of lucerne as a dairy farm crop.

(ii) **Dairy Herd Management.**—The dairy Shorthorn bulls used in the herd have all been carefully selected, and the Guernsey section of the herd consists entirely of pedigree animals.

The milk yield of each cow has been weighed daily since 1921,

and the development of a home-bred herd and the accumulation of records of the quantity and quality of milk yielded by each cow has provided much valuable material for the study of the inheritance of dairy qualities.

The nutritional problems of dairy stock have received considerable attention, and in view of war contingencies feeding experiments with a view to making better use of the foods that are now available, or alternatively of those hitherto regarded as waste products, have been made.

Experimental work on the protein requirements of dairy cows has demonstrated that the previous estimates have been somewhat on the high side.

The experimental treatment of wheat straw for feeding purposes by means of caustic alkali is of interest. By means of a simple treatment, consisting of the immersion of the straw in strong caustic soda, draining off the adhering liquor and subsequent elimination of the alkali by washing with water, it has been found possible to increase the starch equivalent of the straw from 15 to 40.

Encouraging results have been obtained in the use of fodder yeasts. The use of urea as a possible substitute for part of the protein of the diet has been investigated. It has been found that this was assimilated at least in part, but the economic value of the material is doubtful. Moreover, it was found to be slightly toxic.

Lactational Physiology

This department is a section of the Physiology and Biochemistry Department and, among other things, it is concerned with research on methods for increasing fertility in dairy cattle by means of hormones. The effect of the ovary-stimulating hormone of the anterior pituitary gland on the bovine ovary is being studied, and it is hoped that by use of this hormone it will be possible to induce heat in anœstrus cows at will. Conditions under which such treatment will, at the same time, produce super-ovulation resulting in the production of two or three calves at a birth are being sought, and while this would not offer an attraction to the dairy farmer, it might be of value to the beef producer as a means of rapidly increasing the production of meat.

Research on the possibility of increasing the yield and solids content of cows' milk by means of hormones of the anterior pituitary, thyroid gland and ovary is also going on, and encouraging results on the induction of milk secretion in virgin goats by means of the synthetic "ovarian-like" hormone stilbœstrol have already been obtained.

Physiology and Biochemistry Department

The Nutritive Value of Milk and Milk Products.—Much of our modern knowledge of the factors which affect the nutritive value of milk and milk products as human foodstuffs has been derived as a result of the investigations conducted since 1930 by the nutritional laboratory of the Institute, now a section of the Physiology and Biochemistry Department. The effect of different types of feeding stuff and of environment changes to the cow on the vitamin content of milk has been very thoroughly studied, and the alleged damage due to processing of milk has been investigated. New methods for vitamin determination in milk and other foodstuffs have been developed in this department.

Provincial Advisory Service

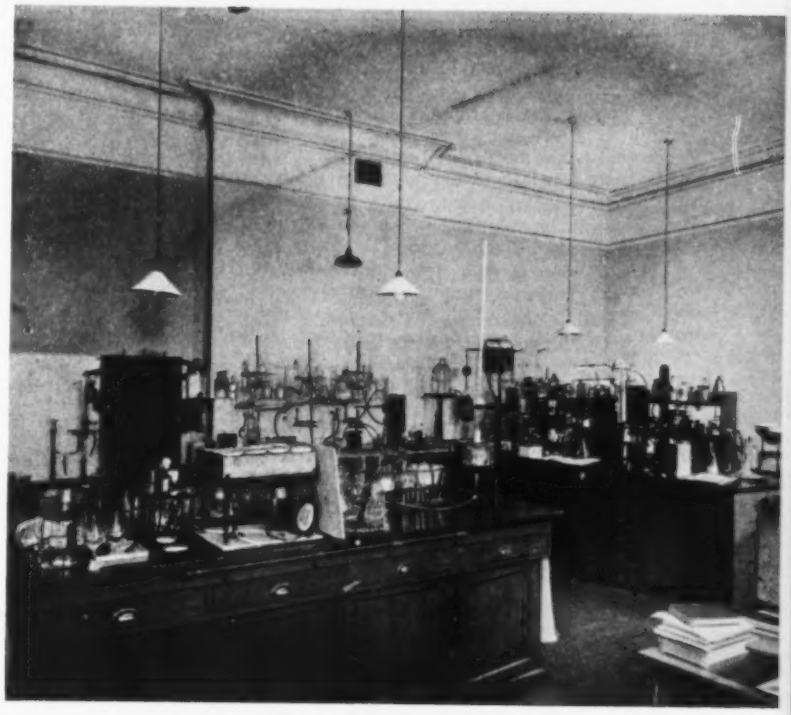
Housed in the Institute is one of the laboratories of the Provincial Advisory Service, by which the Ministry of Agriculture supplies advice to farmers. The Ministry makes a grant to the County Councils, which appoint Agricultural Organisers, who travel among the farmers advising on crops, agriculture and milk production. When laboratory or other specialised help is needed by county organisers, the questions are referred to advisory laboratories grouped in provinces, each of about six counties, and there are ten provinces equipped for this service.

Among the most serious problems dealt with are bacteriological ones, although the laboratories concerned are not equipped for advanced research. The provincial bacteriological laboratory housed at the Institute is particularly well favoured, as it is possible to refer problems to its different departments when necessary. This liaison is extremely useful.

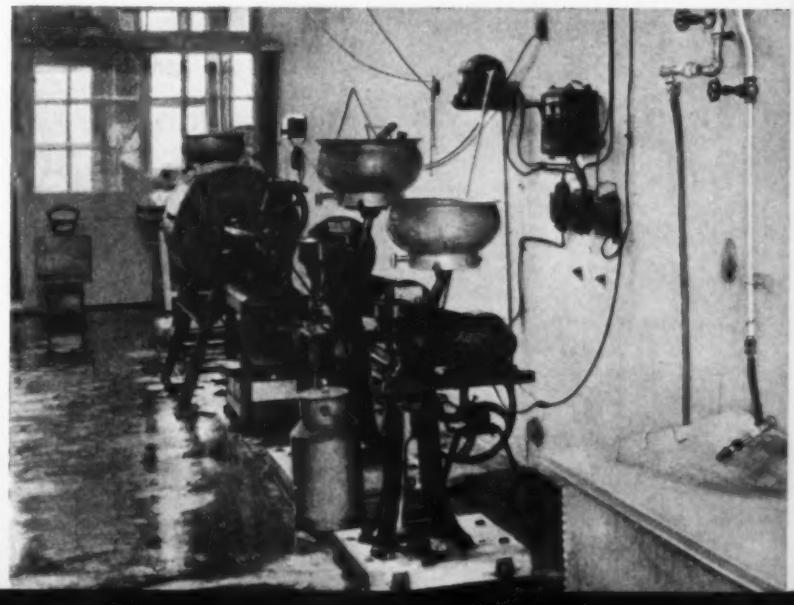
Bacteriological Department

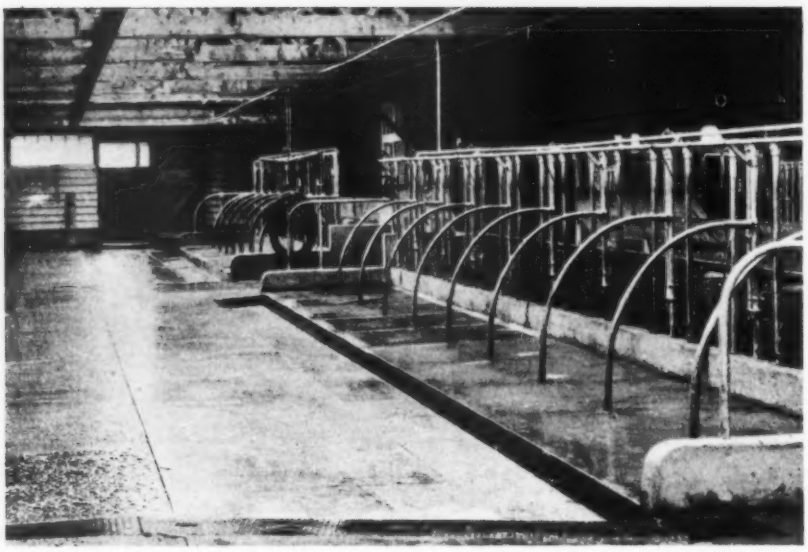
The scope of this department is very wide, ranging as it does from the attack on mastitis as a special war-time measure to the control of the efficiency of dairy plant and equipment. That such work is eminently practical and vital to the country's interest at the present time may be partly gauged by the fact that

The Library.



(*Above*) **One of the Chemical Laboratories.**
(*Below*) **Part of the Experimental Dairy, showing butter maker and separators.**





This cowshed is an example of the practical nature of the research carried on at the Institute. In addition to being a simple cowshed it is an industrial laboratory.
Different types of flooring have been laid and the effects of ordinary wear and tear upon them are plainly seen. On the left-hand bottom corner is a type which has worn badly, while other sections have resisted to a greater or lesser degree.

if mastitis could be eliminated from dairy cattle, the value of the national milk supply could probably be increased by at least £2,000,000 annually.

For some years past high-temperature short-time pasteurisation has been studied, with the result that it has been shown that with efficient plant at temperatures from 160° to 162° F. for 15 seconds (actual), the common pathogenic organisms in milk are destroyed. A marked increase in the keeping quality is also effected, since a reduction in the non-pathogenic flora similar to that of "holder pasteurisation" also takes place.

There are many advantages over the holder method attached to the high-temperature short-time process. It is one of continuous flow, and its rate may be greater than the holder process. There is less plant to clean and maintain, no danger from the growth of thermophiles, little reduction in the cream line and little damage to the other physical properties of the milk. The flavour is excellent. It is the opinion of Dr. Mattick, Head of the Bacteriological Department of the Institute, that in these critical times, when there is danger of disorganisation of supplies and strain on the facilities for treatment, coupled with the shortage of labour, that everyone responsible for pasteurisation of milk should know how to turn at short notice to the high-temperature short-time process. It is more than ever necessary that there is (*a*) no danger of the carriage of disease through the distribution, owing to lack of pasteurising capacity (for whatever reason) of bulked raw milk, (*b*) no loss of an essential foodstuff through souring or other spoilage such as is already threatened.

The matter of the steam sterilisation of dairy plant and equipment has been fully investigated in this department, and as a result the dairyman is able to obtain the fullest data regarding the use of any fuel for the purpose, from wood to electricity.

With commendable foresight, investigations on the emergency sterilisation of dairy plant, such as tanks, pasteurising plant, etc., by means of sodium hypochlorite have been carried out, and the conditions under which satisfactory sterilisation is effected have been established. The possibility of damage to steam sterilising plant cannot be ignored, and the establishment of correct alternative methods may prove of vital importance.

In collaboration with the British Standards Institution, the quality of rubber used in milking machines and its resistance to the use of detergents, hot water and steam have been examined. There are 30,000 machines in daily use in this country, and the question of the durability of rubber accessories is therefore important.

The bactericidal effects of alkalies and wetting agents are being studied. The fundamental coefficients have not yet been worked out, but the department is now engaged in doing this.

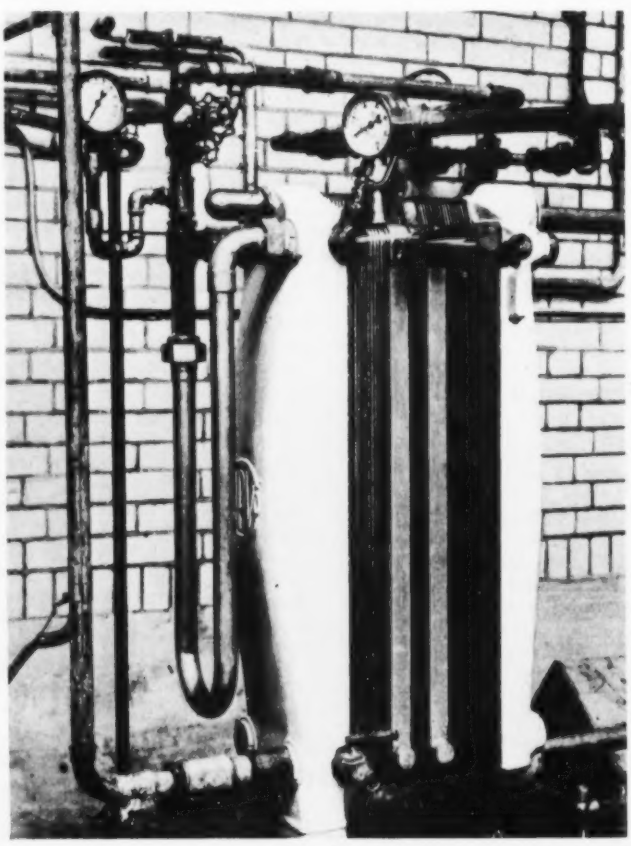
Among the host of other studies, which bear witness to the amazing versatility of the Institute, figure those concerned with cheese ripening. The properties and growth of lactic acid bacilli used as a "starter" are also being investigated.

A series of tests has been made to determine the bactericidal efficiency of an adaptation of the plate type heat exchanger for the pasteurisation of dairy by-products before return to the farm for stock feeding.

There is reason to believe that great benefit would follow the universal use, not only of pasteurised by-products for pig feeding, but also of pasteurised milk for calf feeding, as the infection from the dam with tuberculosis, mastitis, abortion, and other diseases would cease. The advent, therefore, of a cheap and simple process of pasteurisation is to be welcomed. The principle of the new process is the direct injection of steam into the product as it leaves the regenerative section of the heat exchanger. This causes an immediate rise in temperature, which is maintained for about 3 secs. in a short "holding" pipe, after which the product returns to the heat exchanger. The processing temperature is recorded by a bare mercury-in-glass thermometer at the end of the holding pipe.

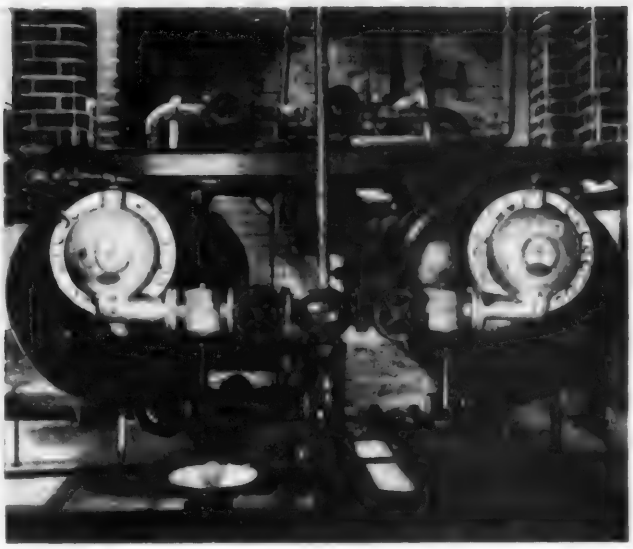
Chemistry Department

The work of the chemistry department may be reviewed under three heads: (*a*) Methods of chemical analysis, (*b*) the composition of normal milk and its variations, and (*c*) the practical application of improvements.



[*Aluminium Plant and Vessel Co. Ltd.*

The pasteurisation of skim milk and whey by direct steam injection.



Hot-water plant heating all sections of the institute.

Much critical and also constructive experimental work on the technique of the determination of the different milk constituents has been carried out in this department. The now well-known phosphatase test to distinguish between properly and improperly pasteurised milk had its origin and development in the researches of the staff of the Institute, and has proved to be a contribution of the greatest value in modern dairy practice.

Among other items, a rapid technique for the estimation of chloride in milk has been worked out. A method for the determination of casein, albumin, globulin and the non-protein nitrogen was evolved in 1930 and has since been applied to many dairy problems.

Another important branch of the work of the laboratory has been on the composition of normal milk and its variations. Masses of data have been collated and studied, and include: Tests of fat and solids-not-fat of every cow in the Institute herd made on three consecutive days in each month since 1922, exhaustive analyses of the milk of a herd of ten Shorthorn cows maintained under typical practical conditions for 5 years, numerous investigations in the Institute and other co-operating herds and the results of extensive tests made by milk depots which the proprietors have made available for the Institute staff.

Among the factors studied which affect milk quality are: Influence of diet, season of the year, stage in the lactation period, drought, temperature and mastitis.

The Library

This is now housed in a separate library building raised as a memorial to the first Director, Dr. R. Stenhouse Williams.

The number of different journals now received during the year is 160. In addition to these, the library receives other periodical literature in the form of bulletins and reports from other research institutes, experimental stations and from various public and private bodies whose work is interesting to those engaged in dairy research. These now amount to about 7,000. There are also over 1,700 standard reference books and monographs dealing particularly with chemistry, bacteriology, biochemistry, physiology, public health and agriculture.

The workers in the Institute are given help in searching the literature by the card-indexing of items likely to be of use in the journals, bulletins and reports as they arrive.

Another aspect of the library work consists in keeping interested people informed of the work done within the Institute, and for this purpose a mailing list is kept of those who wish to receive reports of the Institute and other publications of permanent value.

Testing of Dairy Machinery and Equipment

This is an extremely valuable service, not only to the user, but to the manufacturer of plant and equipment.

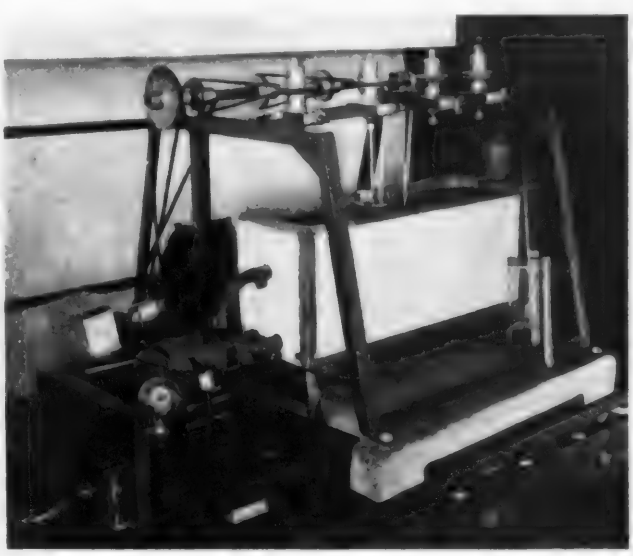
In 1925 the Ministry of Agriculture appointed a committee to arrange for the conduct, at centres approved by the Ministry, of individual tests of agricultural (including dairy) machinery and appliances submitted by manufacturers or their accredited agents. The Institute is the approved centre for tests of dairy machinery. The Ministry issues to the applicant an official report and certificate of the results of the test, and these documents may be used for advertisement purposes. The documents are also published by the Ministry.

The Institute will, in appropriate cases, conduct confidential tests of machinery and appliances. The report of the results of a confidential test is issued direct to the applicant, but the report must not be published or used in any way for advertisement purposes. Confidential tests have proved to be of great value to manufacturers who wish to have an independent opinion of their apparatus or plant before placing them on the market, or before submitting them to an official test under the Ministry's scheme.

The variety of appliances submitted for test is large, and includes cream separators, bottle-washing machines, milk-cooling plants, filters and filtering materials, milk cartons, cattle drinking bowls, milk-weighing tanks, milking machines (including those with automatic recording devices), pasteurisation plants and steam sterilisers.

The Institute has also assisted the Royal Agricultural Society and the British Dairy Farmers' Association in the testing and inspection of plants and apparatus entered in the "New Inventions" classes sponsored by these societies at their annual shows.

(*Continued on page 275*)



Thermostatic water bath with pump circulator and external stirring device for determining the coefficients of alkaline detergents used for bottle washing.

Experimental piggery, showing individual feeding devices. The pigs kept here are used for nutrition experiments.

FLAVOURS IN MILK

An exhaustive review of the present state of knowledge of the subject

JOHN G. DAVIS, D.Sc., Ph.D.

THE question of flavour in milk, as in any food product, is one of outstanding importance. There is no market for any food, no matter how valuable from the nutritional point of view, unless the flavour is agreeable or it is at least devoid of any unpleasant flavour. Milk is a complex and highly unstable liquid food, subject to many spontaneous changes, not only at room temperature, but also at refrigeration temperatures.

From the scientific point of view we may classify the flavours occurring in milk as normal and abnormal, the latter being further classified as physiological (*e.g.*, feed and weed taints), enzymic (*e.g.*, rancid), chemical (*e.g.*, oxidised and cooked flavours), bacteriological (*e.g.*, souring and bitterness) and mechanical or accidental (*e.g.*, paraffin and soap flavours). This classification is summarised in Table 1.

TABLE 1

CLASSIFICATION OF FLAVOURS IN MILK

	EXAMPLES AND CAUSES
NORMAL.	
"Cowy" (slight).	Lower fatty acids, acetone bodies, etc.
ABNORMAL.	
A *Physiological.*	
1. Excessive "cowiness."	Incomplete fat metabolism.
2. Feed flavours.	Volatile principles of feeding stuffs. Silage, turnip, kale, and beet taints.
3. Weed taints.	Volatile principles of weeds. Camomile, garlic, etc.
B *Enzymic.*	
1. Rancid.	Hydrolysis of milk fat by lipase.
C *Chemical.*	
1. Oxidised flavour.	Mild oxidation of lipid (?).
(*a*) Copper catalysed—correlated with high O/R potential.	
(*b*) Spontaneous—(?) independent of O/R potential.	
(Largely controlled by B.O.D. and reducing substances in the milk.)	
2. Activated flavour.	Irradiation of milk resulting in change in albumen (?).
3. Cooked flavour.	Formation of sulphydril compounds by heat. (Appears when milk is heated to 80° C.)
D *Bacterial* (*growth products of micro-organisms*).	
1. Souring.	*Str. lactis.*, etc.
2. Caramel and malty.	Atypical strains of *Str. lactis.*
3. "Unclean" odours.	Coliforms, cocci, gram-negative rods.
4. Amyl alcohol.	*Micrococcus sp.*
5. Vinegary.	Various.
6. Fruity.	Yeasts (mainly).
7. Carbolic.	Spore-forming bacillus in sterilised milk.
8. Bitter.	Aerobic spore formers, etc.
All these are due to unclean methods of production, dirty utensils and holding milk above 65° F.	
E *Mechanical.*	
1. Paraffin.	
2. Soap.	
3. Chlorine disinfectants.	
4. Paint, etc. (by adsorption of volatile constituents).	

Broadly speaking, it may be said that flavours under A decrease on standing; those under B, C and D increase; and the accidentally induced flavours under E remain unaltered.

Normal Milk Flavour

Freshly drawn milk from a healthy udder has a characteristic flavour, best described as "cowy". It is impossible to define this, but it is most probably due to a complex mixture of lower fatty acids and their condensation or oxidation products, "acetone bodies" (acetone, acetoacetic acid and hydroxybutyric acid), carbon dioxide and other volatile products occurring normally in small quantities in tissue fluids. When accentuated it is objectionable, and one of the reasons given for aerating milk—*e.g.*, over the cooler—is to liberate these volatile compounds and so reduce "cowiness" to a negligible proportion. It has been stated that when "cowiness" is excessive it can be reduced by increasing the proportion of carbohydrate in the ration. This is, of course, based on the assumption that "cowiness" is due largely to the intermediate products of metabolism of fats (acetone bodies), and that "fat burns in the flame of carbohydrate".

Milk from an udder infected with mastitis[1] may be already tainted as the result of bacterial growth inside the udder.[2] Hence the necessity of stressing the importance of the "healthy udder" when speaking of "normal milk".

Physiological Taints—Feed Flavours

Perhaps the commonest form is that due to feeds of various sorts. The following tables[3] are very instructive, as showing the preponderance of feed flavours in milks having off-flavours in America.

TABLE 2

Defect.	*No. of Times Noted.*	*Per Cent. of all Observations.*
Feed	2,305	36
Cowy	1,347	22
Rancid	910	14
Stale	872	14
Salt	568	9
Flat	457	7
Sweet	164	3
Bitter	135	2

Samples held 15 hours at 40° F.

TABLE 3

COMPARATIVE INCIDENCE IN EACH SEASON

Per Cent. of Total Observations each Season.

Defect.	*Spring.*	*Summer.*	*Autumn.*	*Winter.*
Feed	42	29	28	43
Cowy	21	21	27	19
Rancid ...	6	9	22	17
Stale	11	28	11	9
Salt	6	9	10	10
Bitter	0	1	5	2
Nil	13	5	6	7

Feed flavours are thus commonest in winter and spring—*i.e.*, when artificial feeding stuffs are fed and grass is not available. Such flavours can usually be attributed to definite feeds—*e.g.*, silage, turnip, kale, beet, etc.

They are definitely due to absorption of the volatile constituents of the feed *via* the blood-stream and not to absorption of "barn odours".[3]

Pasteurisation reduces the percentage of milks judged to possess feed flavours, but it must be remembered that this process increases the proportion of "heated" or "cooked" flavours (Table 4).

TABLE 4

Defect.	*After 24 Hours.*				*After 72 Hours.*			
	Raw.	*Holder Pasteurised.*		*Flash Past.*	*Raw.*	*Holder Pasteurised.*		*Flash Past.*
		Unaerated.	*Aerated.*			*Unaerated.*	*Aerated.*	
Feed	30	20	17	20	22	13	10	16
Heated	2	34	29	14	4	30	26	12
Oxidised	2	3	4	2	4	18	19	14
Nil	43	28	27	47	26	21	22	33

Figures give percentage of cases with a particular defect after various treatments and storage at 40° F. for 24 and 72 hours.

Weed Taints

These naturally occur at definite times of the year, usually in spring and summer. The commonest are given in Table 5.[4]

TABLE 5

Plant.	*Flavour Produced.*
Buttercups (*R. acris*).	Bitter.
Buttercups (*R. repens*).	Unpleasant.
Butterwort (*Pinguicula vulgaris*).	Disagreeable.
Camomile (*Anthemis arvensis*).	,,
Stinking camomile (*A. cotula*).	,,
Wild Camomile (*Matricaria chamomilla*).	,,
Cowbane (*Cicuta virosa*).	Acrid.
Fools' Parsley (*Æthusa cynapium*).	Unusual odour.
Garlic (*Allium sp.*).	As of onions.
Henbane.	Unpleasant.
Hemlock.	,,
Green Hellebore (*Helleboris viridis*).	Bitter.
Stinking Hellebore (*H. fœtidus*).	,,
Black Hellebore (*H. niger*).	,,
Ivy (*Hedera helix*).	,,
Lesser wartcress (*Senebiera didyma*).	Unusua'.
Hogwood (*Polygonum aviculare*).	Bitter.
Lesser Sium (*Sium angustifolium*).	Disagreeable.
Mint (*Mentha sp.*).	Minty—inhibitory to rennet action.
Acorns.	(Cheese develop sharp acid flavour in ripening.)
Pennycress (*Thlaspi arvense*).	Disagreeable.
Rhododendron.	Bitter.
Runch (*Raphanus raphanistrum*).	,,
Tansy (*Tanacetum vulgare*).	,,
Turnips.	Turnip taint.
Water parsnip (*Sium latifolium*).	Objectionable.
Wood anemone.	Disagreeable.
Wormwood (*Artemisia absinthium*).	,,
Yarrow (*Achillea millefolium*).	Bitter.

Weed taints are naturally more frequent when pasture is scarce. Certain cows may, however, show a predilection for certain weeds even when pasture is abundant.

Enzymically Produced Taints

Under this heading may be considered taints produced as a result of the activity of inherent enzymes in the milk. Although strictly speaking physiological, it is convenient to separate these from weed and feed flavours, as there is an important practical difference between them. Whereas feed and weed flavours are strongest when the milk is freshly drawn from the cow and tend to pass off on standing, especially if the milk is aerated, enzymically produced taints may be undetectable on first milking, but become increasingly noticeable on standing. In this respect they resemble chemical and bacteriological taints. The outstanding taint in this category is that of rancidity. "Cowiness" is often a forerunner of this defect,[5] which is a serious one commercially, as there is no way of removing the taint once initiated. Rancidity and bitterness sometimes go together, and it may be recalled that tributyrin is exceptionally bitter. A tendency to give milk liable to rancidity may be inherited,[3] and there is a suggestion that high fat milk is more likely to develop rancidity than low testing milk.[3] Rancidity is a more potent cause of deterioration of flavour when cows are in advanced lactation than when in full milk, or, in other words, the lipase content may be assumed to increase more than usual in the milk of cows liable to give this type of milk. Stale and oxidised flavours do not appear to be dependent on the stage of lactation; saltiness, however, increases as the sodium chloride rises and the lactose falls with advancing lactation. Rancidity is also seasonal, being at a maximum in autumn and winter.

Chemically Produced Taints

Under this heading are considered chemical changes brought about by such substances as copper, or such conditions as heat or irradiation.

Oxidised Flavour

This characteristic flavour (oiliness, "cardboard" flavour, etc.) is common in America, but only of casual interest in this country at present. This is undoubtedly due to the greater extremes of temperature in America, the milk being naturally cold in winter and refrigerated in the hot summers. The taint is associated with low bacterial counts and low temperatures—*i.e.*, it is related to the biological oxygen demand of the milk. An enormous literature exists on this subject, especially in America (see Bibliography), and it is only possible to deal with the problem in outline here. Although of secondary importance at present, an increase in refrigeration in the dairy industry and in the household is bound to result in an increase of this defect in this country.

Two types of oxidised flavour are recognised: (1) That due to contamination with copper from worn coolers, etc., and (2) that independent of copper and occurring in certain types of milk.

Golding and Feilman[6] observed in 1905 that copper contamination in milk could lead to a characteristic taint, and Mattick[7] studied the factors controlling the effect of copper, showing that copper raised the O/R potential of milk from +0·2 v. to about +0·4 v., at which potential oiliness could develop. He also showed that bacterial growth prevented oiliness by lowering the potential to a point at which the oxidative changes necessary for oiliness could not take place.

Greenbank[8] has recently investigated the O/R potential as a factor in producing oxidised flavour. He concludes that this taint is the result of oxidation of some minor constituent of milk, as it is favoured by low storage temperatures, copper, diffuse light and small amounts of hydrogen peroxide. Heating the milk prevents oxidised flavour, presumably because of the production of reducing substances associated with "cooked flavour", while high concentration of H_2O_2 and aeration inhibit the fault by further oxidation of the partially oxidised product responsible for the flavour. Greenbank represents his theory diagramatically as follows:

Mild Oxidation *Stronger Oxidation*

$$R \longrightarrow R.O. \longrightarrow R.O_2.$$

(odourless) (oxidised flavour) (no oxidised flavour)

Copper is effective as a catalyst, because it raises the E_h but does not cause rapid oxidation. A milk that is well poised—*i.e.*, has a high "buffering" effect towards changes in O/R potential—will be resistant to the taint. Greenbank is of the opinion that the fat glycerides are probably not the precursor, but lecithin may be. It is almost certainly a minor constituent.

Enzymes are not responsible, as the taint is best produced at −17° C., and in addition it can develop in milk heated to 185° F. for 5 minutes, but not if aerated afterwards. Low temperatures are effective because of the retardation of oxidation of intermediate compounds.

Barkworth has written valuable reviews on the subject of oxidised flavour,[9, 10, 11] and has emphasised the fact that some milks are so susceptible that they develop oxidised flavour without contamination with copper or exposure to sunlight. In England copper is usually the cause of the trouble and the milk soon acquires a "castor oil" taste. Oiliness, "cardboard", "tallowy" and "cappy" are terms all used to describe this same phenomenon.

The problem of oxidised flavour is quite obviously related to

the presence of oxidants and reductants in the milk. It is not surprising, therefore, that numerous papers attempting to correlate susceptibility to oxidised flavour with the concentration of carotene, vitamin A, riboflavin (vitamin B_2), ascorbic acid (vitamin C) and other reducing substances have been published in the last few years. Space does not permit a critical discussion in this article. Many workers found that feeds high in carotene and vitamin C resulted in milks also high in these vitamins and in which the amount of oxidised flavour was considerably reduced. It is naturally difficult to devise an experiment that conclusively proves such a point as this, as changes in vitamin concentration may be merely effects parallel to those responsible for the production or non-production of oxidised flavour (see Bibliography).

Role of Cells

While on this subject the writer would like to draw attention to the fact that most workers on O R potential phenomena in milk seem curiously to have overlooked the possible rôle of cells (leucocytes, epithelial and glandular cells) in milk. Average milk contains about 500,000 cells per ml., and the reducing activity of freshly drawn milk is practically entirely due to these cells. Thus the resazurin test[12, 13] is for all practical purposes a measure of the cell content of "udder samples",[14] and in their investigations of mastitis in relation to the methylene blue test, McClemont and Davis found a good correlation between reduction time and cell content (as given by the catalase test), but were unable to find any relation between reduction time and "udder counts".[15]

It seems at least possible that in the reduction of dyes in milk,[16] and so for the reducing systems of milk[16, 17] and all related phenomena, of which oxidised flavour is one, the cells in milk are of much more importance than is commonly realised. Thus Davis and Thiel, continuing their earlier work,[14] found that half the reducing power of freshly drawn milk could be separated in the sediment by centrifuging at 18° C.; the other half remained with the fat, the sediment- and fat-free milk having a negligible reducing power towards resazurin. It was suspected that the reducing power of the fat was due, at least in part, to the cells known to be mechanically entangled in the fat globules. Accordingly milk was centrifuged at 50° C., and it was found that this procedure materially increased the reducing power of the sediment at the expense of the fat.[18] (Warm melted fat globules do not retain cells so readily as cooled globules.)

Activated Flavour

Brief mention may here be made of a characteristic taint induced by irradiation and direct sunlight. The fault is also described as "flat" in its early stages and "mushroom", "burnt", "burnt feather" and "burnt protein" in its later stages.[19] On the Continent the term "emery" is also used.[20] Weckel and Jackson[19] state that this taint is to be differentiated from oxidised flavour and becomes more noticeable when the milk is heated to 82° C.

Cooked Flavour

We are all familiar with the smell of heated milk, especially the characteristic odour associated with condensing plants. This is usually attributed to volatile substances containing sulphur and possibly phosphorus and iodine. It is fairly easy to tell overpasteurised milk, but difficult if a temperature of 145° F. has not been exceeded. Pasteurised milk has, however, a relatively flat taste due, at least in part, to the loss of carbon dioxide. Milk treated by the high-temperature short-time process[21, 22, 23] is less liable to suffer in this way, as both heating and cooling take place under pressure.

With flavours due to heating the milk, as with those induced by other agents, experts have attempted to differentiate degrees of flavour intensity. Thus Gould and Sommer[24] suggest that the term "pasteurised" or "heated" be used for low-temperature effects, while the terms "cooked" or "scorched" be reserved for more drastically treated milk. The latter has a sharply defined critical temperature. They were able to detect sulphydryl compounds in milk heated to 80° C. and observed that the O R potential was lowered.[17] The appearance of cooked flavour could be correlated with the formation of sulphydryl compounds, and it is suggested that the H_2S is derived from the serum or fat, not the casein.[25] Josephson and Doan[26] have obtained similar results, and conclude that lactalbumen and/or the "fat globule membrane substance" are the sources of H_2S.

Gould and Sommer have further studied the effect of oxidants and reductants on the appearance of oxidised and cooked flavours. When copper was added before heating, the cooked flavour did not appear until a temperature of 183° F. was reached. Milk only heated to temperatures below this developed oxidised flavour. If added after the heat treatment, both flavours could be produced.[24] Gould further observed that the appearance of cooked flavour coincided with the destruction of peroxidase.[27]

Bacterial Flavours

In spite of the tremendous amount of research, education and propaganda in the cause of clean milk production, bacteria are easily the major cause of taints in milk in this country, and the annual loss must be counted in hundreds of thousands of pounds. Thus, assuming an annual value of £50,000,000 for milk in this country, £100,000 represents only 0·2 per cent.—certainly an estimate on the low side, if we consider not only milk returned to the farmer as unfit for use, but also the vast quantity which is not quite bad enough to be rejected but is a constant source of anxiety to those responsible for the quality of the liquid milk, butter, cheese and other milk products in this country. Ordinary souring is, of course, the commonest bacterial taint in this as in other countries, and it is most frequent in the hot months of July and August. Its occurrence is also appreciable, however, in mild periods at other times of the year *e.g.*, in November—as farmers have by then usually relaxed the preventive measures, such as cooling, which are practised in the summer. Actually the elements of clean milk production are quite simple and (to the bacteriologist) fairly obvious, but the "what father did" tradition in farming is a difficult barrier to surmount.

Broadly speaking, all bacterial faults in milk (*e.g.*, souring, bitterness, specific odours,[28] colour faults, sweet curdling[29]) are due to allowing large numbers of bacteria to gain access to the milk and/or maintaining the milk at relatively high temperatures (*e.g.*, over 65° F.). The following table illustrates the tremendous effect of temperature on bacterial proliferation in clean and dirty milks.[30]

TABLE 6

Plate Count.

Temperature.		*After 24 Hours.*		*After 48 Hours.*	
		Clean Milk.	*Dirty Milk.*	*Clean Milk.*	*Dirty Milk.*
C.	*°F.*				
10	50	11,600	89,000	540,000	1,950,000
13	55	18,800	137,000	3,400,000	38,000,000
16	61	180,000	900,000	28,000,000	168,000,000
20	68	450,000	4,000,000		
30	86	1,400,000,000	14,000,000,000		

The necessary precautions to prevent bacterial taints in milk have recently been summarised by the author.[31]

Accidental Flavours

The most frequent of the flavours coming in this category are paraffin, soap and chlorine disinfectants. These are usually "all or nothing", and the cause is obvious. Occasionally, however, micro-organisms under certain conditions produce substances which might be thought to have been introduced in this way. Instances of this are the carbolic taint in sterilised milk (presumably phenol derived from tyrosine[32]), and the caramel and malt flavours produced by atypical strains of *Str. lactis*. Many bacteria can produce a vinegary taint, and yeasts and a few bacteria can produce the aromas of specific fruits.

The great power that milk possesses for adsorbing odours should not be overlooked. This is due to the chemical forces at the surface of the fat globules, the adsorbing power being associated with the creamy part of the milk. (Incidentally, the surface area of the fat in 1 pint of shorthorn milk is of the order of 100,000 cm.^{2} or 100 square feet!) Cakes and other foods containing cream placed in a recently stained or varnished cupboard, for example, may become so impregnated with the volatile constituents in the stain or varnish as to be uneatable. Milk and cream should, therefore, never be allowed to stand in an atmosphere containing odours of any kind.

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The National Institute for Research in Dairying

(*Continued from page 271*)

Imperial Bureau of Dairy Science

Although not directly connected with the Institute, the Imperial Bureau of Dairy Science is housed in the Institute's buildings. One of eight or nine bureaux dealing with different sections of agricultural science (such as the Bureau of Soil Science, Bureau of Animal Genetics, Bureau of Animal Nutrition, etc.), it was founded three years ago for the purpose of the collection, collation and dissemination of information concerning dairy science.

The Bureau issues quarterly a volume containing abstracts from publications all over the world concerned with dairy research. *Dairy Science Abstracts* circulates widely in Great Britain and the Dominions. Full use is made of the library of the Institute, which greatly facilitates its work.

In the course of a short article, it is impossible to present more than a superficial picture of the activities of the National Institute for Research in Dairying. A fuller account is contained in a volume commemorating its twenty-fifth anniversary, from which I have freely culled for the purposes of this description.

As I passed from department to department and had the privilege of talking to the heads and their assistants, I was struck by the atmosphere of quiet enthusiasm and efficiency which prevails throughout the organisation.

Evidence of a due regard for the future are apparent, one manifestation of which is seen in the arrangements made in the new laboratories for the extension of sections by movable walls, etc.

The æsthetic side has not been neglected. New brick buildings abut on the more venerable Manor House, but the architect has so skilfully handled his materials that a harmonious blend has resulted.

The scope of the dairy industry is an exceptionally wide one, but it would be difficult, as has been attempted to show in the foregoing pages, to find any aspect of it which has not been studied by the workers of the Institute.

To use the metaphor of Professor H. D. Kay, its Director, it is a veritable spearhead of progress of the dairy industry.

SOME SUPPLIERS TO THE N.I.R.D.

Electric Switches: *Crompton Parkinson, Ltd.*
Stoneware Jars: *Doulton and Co., Ltd.*
Fire Extinguishers: *Mather and Platt, Ltd.*
Dynamos: *Metropolitan Vickers Electrical Co., Ltd.*
Cream Separators: *R. A. Lister and Co., Ltd.; Alfa Laval Co., Ltd., The.*
Refrigerating Plant and Installation: *Pulsometer Engineering Co.*
Chemical and Bacteriological Apparatus and Chemicals: *F. E. Becker and Co.; Baird and Tatlock (London), Ltd.; Standley Belcher and Mason, Ltd.; A. Gallenkamp and Co., Ltd.*
Milking Machines: *Alfa Laval Co., Ltd., The.*
Automatic Control: *Short and Mason, Ltd.*
Pasteurisers, etc.: *Aluminium Plant and Vessel Co., Ltd.*
Incubators, etc.: *Charles Hearson and Co., Ltd.*

THE BACTERIOLOGICAL EXAMINATION OF CANNED FOODS

PART 2

T. E. BASHFORD

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THE growth of micro-organisms is influenced by temperature conditions, and there is a minimum below which no growth will occur, an optimum where development is most rapid, and a maximum beyond which no growth will take place. Between the minimum and optimum the growth rate accelerates with temperature increase; above the optimum the rate of growth falls off and then ceases.

Thermophilic Organisms

The organisms so far described have had optimum temperatures for growth between 20° to 40° C. (68° to 104° F.) for most strains, with a maximum temperature about 10° above the optimum. Mention will now be made of some of the characteristics of the *thermophilic* bacteria, the term " thermophilic " meaning heat-loving. The optimum temperature for growth of these organisms is between 55° to 60° C. (130° to 140° F.) and some strains require temperatures above 37° C. (98° F.) to develop at all. The behaviour at different temperatures of an organism with an optimum temperature for growth at 37° C. (98° F.) is illustrated in Fig. 1.

Many of the thermophiles are of interest to canners, since they produce spores of high resistance to heat, and are consequently often responsible for spoilage in non-acid products. The heat-resistance of some of the thermophiles is so great that in certain products it has not been found practicable to bring about their destruction by the process. As far as is known they are not responsible for causing disease, and where they are present in packs which cannot be readily sterilised without adverse effects, advantage is taken of the high temperature required by these organisms for growth. By adequate cooling of the cans after processing and storage under relatively cool conditions such as prevail in this country, it has been found possible to market products containing viable thermophilic spores. It is essential that these products are neither stored near steam pipes, boilers, etc., nor exported to hot climates, as under these conditions temperatures may be created which are suitable for the dormant spores to develop, and spoilage will result.

Classification of Thermophiles

Thermophilic organisms are classified according to the type of spoilage they cause:

(1) Flat sour bacteria, which produce acid in the product but no gas, resulting in souring of the contents while the ends of the cans remain flat.

(2) Thermophilic anaerobes, which produce both acid and gas, giving rise to blown cans.

(3) Sulphide spoilage bacteria, which are also anaerobic bacteria, but which differ from those described in (2) in that hydrogen sulphide gas is produced. When infected by these organisms the cans do not swell as the gas is soluble in the contents. The product becomes blackened and an odour similar to that of rotten eggs is developed.

Thermophiles are found in soil, dust, water, etc., and as far as the canner is concerned raw materials must also be included, although the infection undoubtedly arises from soil or dust. Reports by investigators in America[19, 20, 21, 22], etc., whose results have been recently summarised by Clark and Tanner,[23] show that sugar can be heavily contaminated with these organisms. Cameron and Yesair[22] have reported on their work where a relatively slightly and a heavily infected sugar were compared. Canned corn was prepared with these sugars, and it was found that a recommended process was adequate for the slightly contaminated sugar, while spoilage occurred when large numbers of organisms were present. As a result of these investigations and by co-operation between the National Canners' Association and the sugar industry, sugar suitable for use in the canning industry has been prepared in the States for a number of years.

Incidence of Thermophiles

In this country, fortunately, spoilage due to these organisms has been relatively slight, although the work of Hirst[24] and Barton[25] has shown that infection does exist. Gillespy[26] investigated the thermophile content of sugar refined in this country, and Hirst [27] states that sugar guaranteed suitable for cannery use is now available.

Another source of infection which can be responsible for thermophiles being transferred to canned products is cannery equipment, instances having been cited by Hirst[24] and Cameron.[28] However, by strict cleanliness, the use of hygienically constructed plant and avoidance of wooden equipment, this hazard can be eliminated.

It is clear then that the presence of thermophilic organisms in canned foods indicates under-processing. Where it is not found practicable to process for a time and at a temperature sufficient to destroy these organisms, strict attention must be given to cooling immediately after processing, and to temperature of storage if the possibility of spoilage is to be minimised.

The Examination of Canned Foods

A method for the bacteriological examination of canned foods may be based on the report of Esty and Stevenson[2] of the National Canners' Association, America.

Samples may be required to be tested for sterility or as a part of the analysis of some spoilage problem. It is essential for sample cans intended for sterility tests to be effectively sealed and free from damage. It is clear that if cans are other than mechanically sound, micro-organisms which have gained access subsequent to processing may be grown from them, thereby rendering the test valueless.

When a bacteriological examination is to be made for checking the adequacy of a process, particulars of the time and temperature of processing should also be made available. Without this information it is not possible to indicate whether the heat treatment given is adequate, as the bacteriological examina-

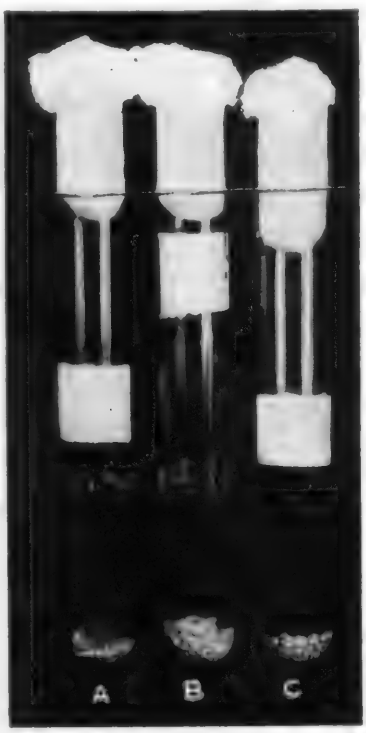

Fig. 1. Growth of an aerobic organisms with an optimum temperature of 37° C., at 22° C. (71° F.), 37° C. (98° F.) and 55° C. (130° F.) (A, B and C respectively). The growth rate is made obvious by the amount of gas produced which has lifted the surface seal.

tion merely determines whether or not the particular samples contain viable organisms. When spoilage has occurred information regarding the raw materials used, method of preparation, particulars of any abnormalities such as unforeseen delay between closing and processing, etc., are often required for consideration with the bacteriological findings before it is possible to make recommendations for overcoming the difficulty.

On receipt, sample cans are examined for defects or abnormal external condition of seams. They are then either placed in incubators or immediately cultured, depending on whether they are sound or blown. With bulged cans, possible opening of seams due to distortion is, of course, taken into consideration.

Incubation of Sample Cans

The purpose of incubation is to encourage the growth of process-resistant spores, which may only be present in relatively small numbers, thereby increasing their numbers sufficiently to make it almost certain that they will be transferred to the culture media when the cans are opened and sampled. There are certain packs, however, the chemical make-up of which (salt content, acidity, presence of curing substances, etc.) does not permit of the ready growth of bacteria, and in these instances incubation of samples may be of little value.

A minimum number of six cans is considered necessary for routine tests for sterility or to determine suitability for sale. Where spoilage is suspected or evident, the number of samples required will depend on the extent of the spoilage, number of batches or days' production involved, sizes of cans packed, etc. Apart from "blown" cans which are examined on receipt, it is usual for two of the samples to be incubated at 37° C. (98° F.) for two days, two at 37° C. (98° F.) for 14 days, and two at 55° C. (130° F.) for 14 days. The samples are examined daily for signs of "blowing" and should this occur they are removed from the incubator for testing. The two cans incubated at 37° C. (98° F.) for two days may, on examination, give an indication of the presence of viable organisms, thus enabling some immediate action to be taken. This avoids delay which might occur if the result of the full examination were awaited. When spoilage has not taken place, these two samples are of value for comparison with the cans which have received the full incubation period.

The incubation of acid products susceptible to spoilage by yeasts, moulds, and aciduric bacteria is carried out at a temperature of 25° to 30° C. (77° to 86° F.) for a period of five days. If higher temperatures were employed the increased acid activity might defeat the object of incubation.

Removal of Samples

A number of methods have been described[2, 3, 4, 29] for the opening and removal under aseptic conditions of a portion of the contents from cans. A range of equipment found efficient in practice is shown in Fig. 2, where "A" is the can-piercing tool which consists of a steel rod with a hardened tip and a metal shield. The purpose of the shield is threefold; it affords some protection to the sterilised can from air currents, serves as a shield from the bunsen flame held at the site of piercing during the opening operation, and guards the operator against spurting of the contents from bulged cans. It is sterilised by burning off with alcohol and then flaming. "B" is a cork borer 10 inches long and 9/16 inch in diameter, which is plugged with cotton-wool inserted at the top end and is wrapped in paper and sterilised in an oven. It is employed when sampling solid material which, in turn, is driven out by a plunger "C" acting on the plug of cotton-wool. "D" is a glass tube for semi-solid products, and "E" a glass pipette for packs containing liquid material. Sterilisation of these is effected in a copper canister, cotton-wool plugs being placed in one end to prevent contamination from the operator's mouth.

On completion of the incubation period the samples are allowed to cool to room temperature, and note is taken of any changes which may have occurred during the course of incubation. One end, or in the case of shallow cans (*i.e.*, with the diameter greater than the height) and of flat ovals or rectangular shapes (fish cans), one side, is selected for opening and is sterilised by cleaning with soap and water and burning off with alcohol. Finally, it is flamed with a bunsen and covered with half of a sterile petri dish. When the piercing tool has been sterilised, the petri dish is lifted from the can and a hole is made in the centre of the end. While this opening operation is being carried out, the tip of a bunsen flame is held at the point of entry to ensure that only sterilised air enters the can should it be under reduced pressure.

The technique for removing samples must necessarily vary slightly, depending on the consistency of the product, and the apparatus found suitable has already been described. Solid products, such as meat roll, are sampled with the cork borer. A portion taken by cutting from end to end of the can in a vertical direction, passing through the centre of the pack, is transferred to a flask of sterile water. This sample is thoroughly broken up by shaking and the resulting suspension is inoculated into the culture tubes. With packs containing liquid, the gravy, brine, etc., is withdrawn by means of the bulb pipette and portions inoculated directly into culture media. Some products—milk puddings, for example—are of such consistency that they cannot be removed by means of either of the methods just mentioned, and for these it is convenient to use a glass sampler of similar size to the cork borer. The requisite amount of material is taken by suction, cultures being made after mixing with sterile water. By employment of these various methods, some 25 millilitres or grams of material are cultured from each can.

Fig. 2. Can opening and sampling apparatus.

System of Cultures

From what has already been said it will be clear that various groups of organisms are responsible for spoilage in canned foods; the medium required to establish the presence of spoilage types varies to meet the growth requirements of the different organisms.

For the routine examination of non-acid products, aerobic and anaerobic cultures are incubated at 37° and 55° C. for a period up to five days irrespective of the incubation conditions to which the cans have been previously subjected. The culture media for anaerobic organisms are those recommended by Cameron,[30] and dextrose broth is included for the isolation of aerobic and facultative anaerobic strains. In addition to these, milk medium with added indicator is used for milk and cream packs, as Nichols[31] reports that most organisms which cause spoilage in canned milk products seem to grow well in litmus milk and dextrose broth.

With regard to acid foods, the tomato media of Esty and Stevenson,[2] together with dextrose malt extract broth, are used for routine tests. The acid nature of these foods only permits the development of yeasts and certain aciduric organisms, and the media have been found to be of value in separating these spoilage types from organisms unable to grow in acid substrate. For the detection of *B. fulva*, a potato-sucrose medium described by Olliver and Rendle[8] is employed.

Subsequent treatment of positive cultures involves at least the transfer to solid media, special staining methods or heat-resistance tests for confirmation of spore production, or the establishment of non-heat-resistant types and, depending upon the implication of finding viable organisms present, classification, heat-resistance studies, reproduction of spoilage in the foodstuff by inoculation tests, etc.

Recording of Vacuum

In connection with some samples it is required to know the amount of vacuum in the can, and to permit this to be recorded under aseptic conditions the apparatus shown in Fig. 3 has been made. An ordinary vacuum gauge fitted with a detachable piercer has been secured to a frame which has an adjustable platform for holding the can in position. The piercer has been fitted with a side-limb by which filtered air can be admitted to the can after registering the vacuum. The piercing tube and side-limb are packed with cotton-wool, and the detachable end is sterilised wrapped in paper. To measure the vacuum in the can, the sterilised piercer is screwed into position and the paper is removed. At the same time the previously sterilised end of the can is held against the rubber washer. The platform is raised up to the bottom of the can by the hand wheel and the final piercing is brought about by means of a lever attached to a cam which lifts the can about a quarter of an inch. To relieve the vacuum the cap at the end of the side-limb is removed, thereby allowing filtered air to enter. After dismantling. the can is re-covered with half of a sterile petri dish, and is ready for the removal of samples.

Further determinations which may give correlative evidence for consideration along with the results from incubation and culture tests are: direct microscopical examination of the can contents, measurement of hydrogen ion concentration (*p*H), examination of the contents and the findings from a physical examination of the can.

Direct Smears

Stained smears made from the can contents will usually give an indication of the number, type and condition (*i.e.*, sporing, degeneration, etc.) of the organisms present. The information may not be conclusive, but is particularly helpful where spoilage is suspected but negative cultures are obtained, as may occur where the organisms have been destroyed by the products of their own metabolism.

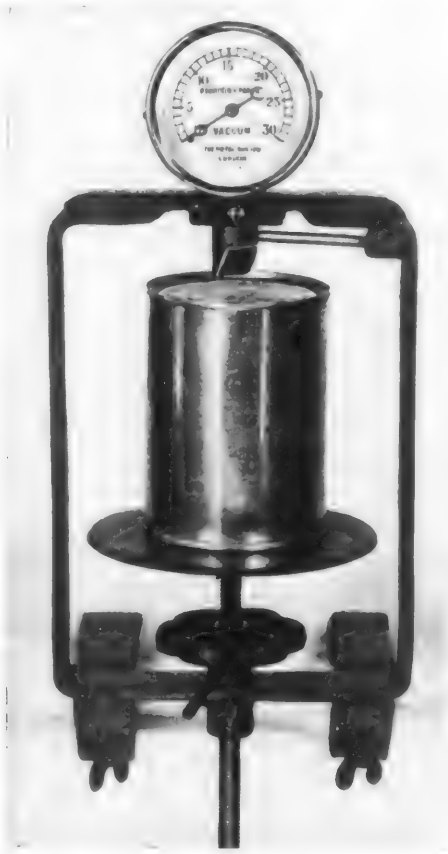

Fig. 3. Apparatus for recording vacua under aseptic conditions. The rubber washer which forms an air-tight seal between the can and the gauge has been cut to show the can piercer.

Determination of pH

Information concerning the hydrogen ion concentration may be of value in substantiating evidence of acid production arising from bacterial development. The determinations are made colorimetrically, and whilst it is appreciated that the findings may not be strictly accurate, they are sufficiently reliable for comparison to be made between representative samples incubated at 37° and 55° C.

Examination of Can

In general the can is examined in order to decide whether it conforms to predetermined standards, a matter calling for some knowledge of can fabrication. After inspection for obvious defects, such as loose or wide seams, damage due to handling or faulty adjustment of the closing machine, etc., the end seams are filed open and measurements made of end and can hooks. Prior to opening, similar observations are made for seam width and overall depth. It may be said that in general, decisions as to the soundness of the seams, based on an inspection by a qualified observer, are in agreement with the report of the bacteriologist on the question as to whether the can has been infected subsequent to processing or not.

Pathogenic Micro-Organisms

The information available on the behaviour of micro-organisms in canned foods is not perhaps complete, but for a number of years there has been an understanding of the requirements to be fulfilled in order to ensure safety from food poisoning. Many canners are known to be processing under conditions which suffice for the destruction of *Cl. botulinum*, the most heat-resistant of the food-poisoning bacteria, or are handling products on which there is evidence to indicate that disease-producing organisms would not develop should they be present. A comparison between the total number of cans packed and the number of food-poisoning outbreaks that have been reported confirms this or suggests that food-poisoning organisms are of rare occurrence. The bacteriological examination of canned foods is, therefore, primarily concerned with the search for spoilage organisms, it not being considered practicable in routine work to attempt to isolate pathogenic types.

For the investigation of suspected food-poisoning bacteria, special tests are often necessary which are more appropriate to the public health laboratory, and for this reason no mention has been made of this aspect of canned food examination.

Though strictly outside the scope of this article, it may be useful here to emphasise the necessity for prompt action in the event of a complaint being made of illness arising from the consumption of canned food, in order to ensure that the evidence for the allegation is made available and properly assessed. Where such instances arise, canners will naturally turn to the Research Organisation to which they subscribe or to a reliable consultant. Effective arrangements exist for the prompt collection and sifting of the evidence bearing on a complaint or claim of this nature.

My best thanks are due to my colleagues for their assistance in the preparation of these articles, and to Mr. J. F. Morse for producing the photo-micrographs.

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PART I, PAGE 182.—ERRATA

Second column, first paragraph, line 5: *p*H 6·0-7·0 should read *p*H 6·8-7·0.
Second column, first paragraph, line 10: *caramel* products should read *canned* products.

FOOD AND POISON GAS

THE Ministry of Food have issued a memorandum on arrangements for dealing with food contaminated by poison gases, which deals with administrative control and responsibility, instruction of officers, duties of officers, co-operation with the chemical staffs of food firms, and other matters.

The following list of publications for the use of officers and others covers the subject in a practical way :

Ministry of Food Handbook : "Food and its Protection against Poison Gas."
A.R.P. Handbook No. 1 : "Personal Protection against Gas."
A.R.P. Handbook No. 4 and No. 4A : "Decontamination of Materials."
A.R.P. Handbook : "The Detection and Identification of War Gases."
A.R.P. Memorandum No. 11 : "Gas Detection and Identification Service."
A.R.P. Handbook No. 7 : "Anti-Gas Precautions for Merchant Shipping."

The recommendations regarding the decontamination and treatment of foodstuffs affected by poison gases are as follows :

The Decontamination of Foodstuffs Affected by Poison Gases

1. Lung-Irritant Gases (Non-Persistent). (Chlorine, Phosgene, Diphosgene, Chloropicrin.)

It is unlikely that exposure of foodstuffs to these non-persistent gases will result in their edibility being affected to an extent that cannot be made good by airing. Foodstuffs or packages of foodstuffs should be spread out in a place—preferably covered—where circulation of air will carry away residual gas as rapidly as possible. Increasing the movement of air by artificial means such as the use of fans will be helpful in accelerating decontamination. Airing should be continued until there is no trace of smell of the gas. In most cases a period of about 24 hours will suffice. Generally speaking, it will not be necessary to empty foodstuffs from containers in order to facilitate dispersal of the gas. Foodstuffs in sacks or other permeable containers are soon decontaminated if air is allowed to circulate freely round the exterior. A pile of sacks containing flour, grain, potatoes and similar foods only require to be taken down and stacked so that air circulates freely between each sack.

After airing, foodstuffs should be carefully examined to ascertain whether their quality or their palatability has been impaired as the result of exposure to gas. (Flour may become slightly acid, and tea may be rendered rather bitter.) This examination should be carried out with a view to ascertaining whether it is practicable to restore the material to an edible condition by appropriate blending with unaffected supplies.

2. Tear Gases.

(*a*) Non-persistent. Treatment of foodstuffs contaminated with non-persistent gases of this type should follow the lines indicated in paragraph 1.

(*b*) Persistent. Owing to the unpleasant smell of the vapours of these gases (*e.g.*, ethyl iodo acetate [K.S.K.], bromobenzyl cyanide [B.B.C.]), there is considerable danger that foodstuffs which have come into contact with them will be rendered unpalatable. If the extent of contamination is thought to be slight, treatment by the airing procedure described in (1) should be tried. If this results in all trace of smell of the vapour being dispelled, the food in question will probably be free from contamination likely to be a source of danger. If there is any doubt, material should be submitted for analytical examination.

Successful salvage will depend on the extent to which gas has penetrated the wrapping and contaminated the foodstuffs inside. In the majority of cases this will probably be slight.

Contamination of foodstuffs by splashes of liquid tear gases may necessitate their being condemned as unfit for food, although in each case the possibility of separating the more heavily contaminated material and airing the remainder should be considered.

If liquid tear gas splashes have contaminated the outside of boxes, sacks or other coverings of foodstuffs, it is advisable to remove the packages as quickly as possible to the open air or to a covered site where there is a good circulation of air. Speed is essential in view of the rapidity with which these liquids penetrate soft wooden boxes or sacks. The sooner the foodstuffs are removed from the affected containers and aired to remove vapour, the greater will be the chances of effecting salvage. Liquids such as beer and milk, affected by persistent tear gases, will probably be rendered so unpalatable that they have to be destroyed.

3. Non-Irritant Gases.

The arsenical compounds employed as nose-irritant gases are liberated in the form of smokes, which consist of exceedingly minute particles of solid and are, therefore, similar in character to tobacco smoke. They are rather readily dispersed, and for that reason these gases are classified in the non-persistent group. Foodstuffs which have come into contact with gases of this type should be treated by airing, as described under paragraph 1, *but must in all cases be held under suspicion in view of the danger of arsenical contamination.* After airing, these foods should be sampled for chemical examination by the Public Analyst or other appointed chemist, and should not be released until analyses have shown that the arsenic content does not constitute a danger. In this connection it should be remarked that it is not considered probable that the degree of contamination likely to arise from nose-irritant gases will be serious. Water in tanks or other supplies used for drinking purposes, which become contaminated by nose-irritant gases, must be run away until the supply shows no detectable trace of arsenic on analysis.

4. Blister Gases (Non-Arsenical).

(a) *Vapour Contamination.*—Foods affected by exposure to the vapour of blister gases, such as mustard gas, should be subjected to airing as promptly as possible. This treatment will probably restore all *except those of a fatty nature* to an edible condition. Owing to the rapidity with which fats absorb blister gas vapour, fatty foodstuffs are liable to become rather seriously contaminated. In the majority of cases this contamination will affect only the superficial layers of foods such as butter, bacon and fatty meats. Penetration will seldom extend beyond 20 mm., even after 24 hours' exposure to a relatively high concentration of vapour. All foods which have been in contact with mustard gas vapour must be held, whether they have been subjected to decontamination treatment or not, until analysis has determined whether or not they are dangerous. If there is any doubt concerning a perishable food such as fish or milk, it should be condemned.

(b) *Spray or Splash Contamination.*—Relatively light contamination of exposed foodstuffs by very small droplets of blister gas does not necessarily mean that they will have to be condemned. Where it is practicable to wash the surface with a stream of water, as in the case of potatoes, oranges and some other foods, this should be done before they are subjected to airing. It may be practicable in the case of a few foodstuffs to cut away the contaminated surface to a depth of about half an inch. The remainder can then be aired. It will be appreciated that this procedure must be carried out with the greatest care if it is attempted.

Light droplet contamination of food containers such as wooden boxes, crates, sacking, meat cloths, etc., may also prove less troublesome than might be expected. Packages should be removed with as little delay as possible to the open air or to a covered airing site where the coverings or wrappings can be removed and the foods themselves subjected to airing. The contaminated wrappings and cases should, of course, be removed for destruction.

Heavy droplet contamination of exposed foodstuffs will be very difficult to deal with, but it should not be assumed that all foods affected in this way are necessarily to be condemned. Hosing down of such foods as can be handled in that fashion will considerably reduce surface contamination and may enable one to complete decontamination by subsequent airing. Examination of the penetration of mustard gas from large drops on the surface of various types of food shows that in 24 hours, under ordinary conditions, there is seldom significant contamination deeper than ¼ inch below the exposed surface. A considerable proportion of certain foods such as large cheeses, etc., might, therefore, be saved by promptly and very carefully cutting away half an inch or more in depth of the contaminated surface. The remainder

should be aired. Liquids such as milk, cream, beer, drinking water, etc., must be condemned if contaminated by droplets of mustard gas or similar blister gas.

Heavy contamination of food containers by liquid mustard gas will require special treatment, depending on the character of the container. The outside of sealed metal containers can safely be treated with the usual watery suspension of bleach, after which they can be washed or hosed down, but greater caution would be required in the case of watertight wooden barrels *heavily* contaminated. There is a possible risk of the blister gas being absorbed by the wood and ultimately reaching the contents. With gross contamination the contents should, if possible, be transferred quickly to fresh containers, and the barrels can then be completely decontaminated or destroyed according to circumstances. Generally speaking, the use of solvents such as paraffin or petrol is not recommended. There is always the danger that contamination may be spread rather than reduced by swabbing down with these materials.

The usual type of wooden box is rapidly penetrated by liquid mustard gas owing to the presence of minute flaws, invisible to the naked eye. Cardboard boxes, except those impregnated by resistant materials such as wax, are also rather rapidly penetrated by liquid blister gases. It may be necessary to treat the outside of contaminated boxes with bleach paste in order to reduce the danger from handling, but, in general, the important thing is to remove the boxes as quickly as possible to a site, preferably in the open air, where the foodstuffs can be extracted and taken to a place suitable for airing. This is a relatively simple matter where the contents of the cases are tins. A number of other foods, usually packed in boxes—as, for example, butter and margarine—are protected to quite a considerable extent by the linings and wrappings commonly employed. Unless liquid mustard gas has penetrated the wood and badly contaminated the surface of inner coverings it will probably be found that the foods themselves are unaffected. Speed of action is all-important.

Sacks, hessian bales and crates contaminated by splashes should be removed to the open air as promptly as possible. It will be necessary to remove the contents to an uncontaminated site for airing.

Foods, particularly in large quantities, or if of considerable value, which have become in contact with blister gas, either in liquid or vapour form, should, in general, be held after treatment for expert examination by an analyst before ordering their destruction.

5. Arsenical Blister Gas (Lewisite).

The general treatment of foodstuffs affected by Lewisite should follow the lines indicated for use in cases of mustard gas contamination, but it must be borne in mind that the danger of arsenic poisoning is very much greater than where nose-irritant arsenic gases are concerned. Foodstuffs which have come into contact with Lewisite in liquid or vapour form must be regarded with the greatest suspicion. If not condemned at once, they should be held for examination by the analyst.

6. Transport of Contaminated Material.

So far as is practicable, contaminated foodstuffs being transported for salvage or for destruction should be placed in metal or metal-lined containers or vehicles (*e.g.*, metal refuse collectors, metal-lined vans, steel barges). If the material is heavily contaminated and there is little chance of it being salvaged, steps should be taken whenever possible to render it relatively harmless before it is transported. Thus, for example, carcases heavily contaminated with mustard gas splashes, and certain, therefore, to be destroyed, should be sprinkled with bleach powder.

7. Decontamination Sites.

It is recommended that attention should be given to the selection of sites suitable for decontaminating contaminated foodstuffs.

The most important decontamination treatment is airing. A site suitable for this should be one giving protection from the weather, but at the same time permitting foodstuffs in quantity to be distributed so that free circulation of air will carry away residual gas as quickly as possible. The danger of vapour contamination downwind must always be borne in mind.

The choice of the decontamination site should also be made with due regard to the possibility that it may be necessary to wash down certain foods or containers with a gentle stream from a hose-pipe, or that quantities of tins or bottles may have to be treated with bleach paste, followed by washing and drying off.

8. Destruction of Contaminated Foodstuffs.

Burning in a bright fire is recommended. If the fire is not burning strongly, there is a danger that poisonous material will be volatilised into the atmosphere by the heat instead of being decomposed.

Wrappings, boxes and other materials contaminated with liquid mustard gas should be burnt at the earliest opportunity. If there is a likelihood of delay occurring, it would be advisable to sprinkle the material with bleach as a temporary expedient. For obvious reasons it is advisable that the site of destruction should be as isolated as possible.

Contaminated foods can also be disposed of by burial if the necessary precautions are taken beforehand to render them harmless. This is not as satisfactory as burning. Those contaminated by liquid mustard gas should be liberally sprinkled with bleach powder before covering with soil. Burial should be such that a depth of not less than 3 feet of soil covers the condemned material.

9. Advisory Service.

Enquiries on technical questions concerning the protection of foodstuffs against poison gas or treatment of the contaminated foodstuffs should be addressed to the Scientific Adviser, Ministry of Food, Neville House, Page Street, London, S.W. 1.

COMPOUND AND MIXED FEEDING STUFFS

In the article "The Manufacture of Feeding Stuffs for Livestock," by T. Crosbie-Walsh, F.I.C., published in last month's issue of Food Manufacture, mention was made of the Compound and Mixed Feeding Stuffs (Control) (No. 2) Order, 1940 (S.R. & O., No. 1119).

The Minister of Food has made an Order which came into operation on October 7 amending this Order, the principal effect of which is to prohibit the use of wheat in compound and mixed feeding stuffs other than poultry foods, and also to prohibit the manufacture of wheat provender mixture and flaked or rolled wheat mixture. This has been done to ensure that the reduced proportion of home-grown millable wheat, which may now be used for feeding purposes, is reserved for poultry.

Minor changes have also been made in the technical details relating to the composition of the prescribed compound and mixed feeding stuffs. In the case of compounds these changes include an amendment of the permitted oil content of certain compounds; the restriction of the use of dried milk products as feeding stuffs to calf gruels and baby chick food; restriction on the use of cocoa residues and the inclusion of "licensed molassed feeding stuffs", distillery dreg meal, kaffir corn and tares, as permitted ingredients in the preparation of compounds. A licence is still, however, necessary to manufacture molassed feeding stuffs. The permitted mineral content of certain compounds has also been amended—*e.g.*, the alteration in the salt content of national poultry foods, other than national baby chick food, will allow the addition of approximately one-half per cent. of free salt when the compounds are made from normal materials.

In the case of cereal mixtures, both maximum and minimum proportions of the ingredients are now specified and barley may be substituted for whole wheat in national poultry corns.

PLUM JUICE

Juice from plums which have been blanched by the Cruess hot water method can be prepared with only 5 per cent. of added sugar if the ratio of blanching water to pulp in making the juice is 2 : 1, according to V. L. Flaumenbaum (*Konservnaya i Plodoovoshchnaya Promyshlennost* 10, No. 5, 15, 1939). This ratio is better than using equal volumes of blanching water and pulp. The juice has an excellent plum flavour and aroma, with more body than when the water : pulp ratio is 1 : 1. Yield of juice is decreased somewhat (to 63 per cent.), but this is very favourable in comparison with yields reported by the Glavkonserva cannery, where the standard is 49 per cent. Some tests were also made with sugar syrup instead of blanching water, but the results were less satisfactory. Juice made with 15 per cent. syrup in the ratio of 1 : 1 was not sweet enough, while juice made with syrup in the ratio of 2 : 1 was too thick. Plum juice having the best properties was obtained from pulp containing 5 per cent. sugar and 10·9 per cent. dry matter, with 0·55 per cent. acidity. The final sweetened juice contained 12·39 per cent. sugar and 17 per cent. dry matter, with 0·23 per cent. acidity (Through *Food Industries*.)

THE BACON AND SAUSAGE INDUSTRY IN FRANCE

This article was written prior to the occupation of France, but it is still of interest by reason of the high state of efficiency to which the sausage and bacon industry reached in that country. C. de CHESSIN, the author, is a French consulting engineer with long experience in the construction of food plants

A BRANCH of food manufacture which has been particularly developed in France, is that of the preparation of bacon, sausages, canned meats, and similar products.

Compared with the methods formerly used, improvements lie more particularly in the more rational organisation of plant, wider use of mechanical refrigeration, use of new machines and the application of modern methods of handling. These points will be taken in order.

Organisation of Plant

The first step in the organisation of the plant is to provide a rational layout. After a study of the movement of the goods, from the arrival of the raw material to the despatching of the finished product, the various services and shops should be so arranged as to reduce handling to a minimum, and obviate any doubling back.

It is not always possible to follow these general principles to the letter, for other conditions may have to be considered, such as the need for grouping all the refrigerated rooms in a single block in order to simplify the distribution of the cooling fluid and reduce cold losses. Similarly, it may be desirable to assemble the cooking, sterilising and other heat-consuming services, not only to simplify heat distribution, but also to localise the production of steam in one part of the plant. Although these ideas of rational organisation have been widely applied in the mechanical and metallurgical industries for years, it is only within the last 12 to 15 years that they have received application in the French food industries, so that it is only in the more recent plants that rationalisation can be seen.

In such plants the reception of meat, with sanitary or quality control, weighing, etc., is generally arranged next to the cold storage room in which the meat is stored. Next comes the cutting room, in which meat is prepared for the various individual products: bacon, sausage, canned meat, etc., and here there is a second weight control. Each product is in its turn treated in a series of shops, arranged in accordance with the requirements of manufacture, to end finally in the stock room, with its despatching service annexed.

In order to permit rationalisation along the lines of this theoretical perfection, some of the most recent plants in France have been built in a number of floors, and the meat as it enters is raised immediately to the top. From here the meat comes down from one floor to the next as its preparation proceeds, to end up in the stock room and despatching department on the ground floor. Steam, power, and refrigeration plant is grouped in a single section or building, and in this connection it is interesting to note that in a few plants this building is provided with a meter room, grouping electric meters, hot and cold water meters, steam meters, etc., by departments, so that it is possible merely by reading these meters to calculate the cost of operation of each shop.

Other improvements have also been made, the most important of which is the realisation of the need for constant and absolutely hygienic conditions. Tiled floors and walls, provision of ample light, air and water throughout the plant, and large dimension sewage and refuse evacuation systems are the principal results of this.

Use of Refrigeration

The use of refrigeration has been general, in French sausage plants, for a number of years. It is interesting to note, however, that plants have not confined themselves to the use of mechanical cooling systems solely for the maturing rooms but have spread it over every phase of manufacture. It is used for the storage of fresh meat; for the pre-refrigeration of meats intended for salting; there are cold storage rooms for the meats after they have been out and after they have been chopped, and again for the finished products. Cold is also used for solidifying lard, for chilling the brines used for pickling and for the air in the sausage dryers.

For the manufacture of sausage, which is very widespread in France, the sausages, after having been passed through a heating cabinet, are dried for a variable period of time. Formerly, plants depended upon weather conditions and the outside temperature. The use of refrigeration, however, permits the temperature of the drying room to be regulated exactly (generally to about 12° to 14° C.). The relative humidity is likewise regulated, generally to about 75 per cent., so that sausage manufacture is no longer a seasonal business.

The air which is to be forced into the drying rooms is first passed over cooling coils, which causes it to lose part of its moisture. It is then reheated to the desired temperature by steam coils, and distributed throughout the room by ducts placed in the ceiling and in the floor, so that the air current passes over the whole surface of the sausages, which are hung on frames. A system of air valves permits the direction of flow of the air to be changed from time to time. The evacuated air, saturated with moisture, is again passed over the cooling coils, to begin its cycle of movement over again.

This type of installation has become quite general in France, and has permitted numerous plants to produce from 5 to 8 tons per day of sausage. Air conditioning is also used in the preparation of other products, notably *mortadella* and certain hams, such as Bayonne ham and Bologna ham. This use of air conditioning is certainly the most recent application of refrigeration, and has very notably modified methods of manufacture.

In order to give an idea of the means now used to produce meat products, the preparation of various products will be briefly sketched, and the improvements which have been made in machines or in methods will be noted.

Preparation of Sausages

The machines used are, obviously, the same as those used everywhere: cutters, mixers, stuffers, etc., and the improvements in these machines are to be found in all makes, whether they be English, French, or of other nationalities. It would be useful to note that the tendency is towards a suppression of belt drives, which are replaced by individual motors built into or coupled with the individual machines, with drive by chain running in a closed casing.

Enterprise cutters are being made for increasing capacities, with automatic feed of the meat to be cut. Models with a capacity of 1½ to 2 tons per hour are frequent. Both vertical and horizontal type mixers are used, the latter having a greater capacity, and being provided with one or two mixing screws. Mechanical stuffers are generally operated by oil pressure rather than by compressed air, which was found to leak very frequently and to mix with the meat. Capacity is from 60 to 80 litres with either one or two outlets, and the machines are combined with dividing and twisting machines, to provide sausages of exactly equal weight.

For filling cans of meat pastes, automatic machines with endless chain feed of the cans to be filled are used. Some models have the filling controlled by a volumetric pump system.

In all the modern plants these various machines are arranged in a certain order so that the operations follow in succession, from the Enterprise cutters to the stuffing tables.

Preparation of Tinned Hams

This line has been considerably developed in France. Nearly all makers of ham now have canned types, and some prepare up to 2,000 or 2,500 hams per day.

After trimming, the hams are salted. Various methods are used to accomplish this: injection of chilled and filtered brine, rubbing with dry salt, or injection of brine in the veins. This last method is coming very much to the fore, as it considerably shortens the time required for salting. A few old and well-established houses, however, still prefer their old method of leaving the hams in a very weak brine for several weeks; in certain plants salting takes 40 to 45 days.

Naturally, the salting always takes place in refrigerators, and in many plants the hams are pre-chilled before being placed in the salting vats. After remaining for a longer or shorter time in the vats, the hams are piled up with salt on shelves in refrigerators to mature, being turned over from time to time.

On leaving the salting vats the hams are washed and brushed to remove the coating of salt, then drained before going to the hot rooms, in which the temperature may be anything between 30° and 60° C. according to the manufacturer. The hot rooms are generally heated by steam or electricity and are provided with ventilator fans to keep the air in motion and to renew it. Temperature is maintained by a thermostat which acts on the steam valve or on the electric current switch. This heat treatment lasts from 8 to 12 hours and permits from two to three per cent of the moisture in the hams to be removed.

The duration of the smoking process varies with the region and the taste of the customer, from 8 to 18 hours. It is carried out either cold (in which case the hams are allowed to cool after their heat treatment) or hot. In certain plants the smoking and the heat treatment are combined, the smoke rooms being provided with radiators or heating coils.

Smoke Rooms

Smoke rooms have been the subject of a number of improvements, and we shall describe some of the types used. Individual smoke rooms are generally about 4 feet square and 10 feet high. The fire box is in the lower part of the room and is lined with fire brick. The smoke is generally produced from sawdust, and a gas lighter is used to light it without having to open the door. Regulable baffles separate the fire box from the smoke chamber, the regulation taking place from outside the apparatus. When the smoke room is in use, the baffles are open, and the smoke rises freely. Before the hams are put in or taken out, a lever permits these baffles to be closed, keeping them from entering the chamber, and directing them to a by-pass conduit. This system is particularly convenient, as it permits smoke to be kept out of the room in which the men are working. Steam coils or gas burners permit the temperature in the smoke chambers to be regulated.

Groups of smoke chambers are also used, arranged either vertically or horizontally. In the former case the smoke producer is generally in the basement, and is filled either automatically or by hand. When the chambers are horizontally arranged, and sometimes even when the arrangement is vertical, the smoke is produced in a special apparatus from which it is forced by a fan and distributed by ducts to the various chambers. A system of valves permits the quantity of smoke sent to each chamber to be regulated, while thermostats control the temperature.

Ham Canning

After smoking, the hams are boned and canned or moulded. There is little to be said of this canning, except that the hams are pressed in moulds before being canned, the mould being exactly the size and shape of the can. The presses are either hand or hydraulically operated; certain of them permit the hams to be pressed in the cans themselves.

After the can has been closed the air is pumped from it, and it is soldered in a vacuum, either in an apparatus which handles one can at a time, or in a rotary tunnel in which from 12 to 20 cans can be placed.

The greatest novelty in ham preparation lies in the manner of cooking, which formerly took place (as it still does in many plants) in autoclaves for canned hams and in vats of hot water for moulded ones. Now, however, the use of cooking cabinets, in which the hams are cooked by dilute steam, is spreading. Originally built in wood, they are now almost entirely in stainless metal, frequently in galvanised sheet, with a lining of enamelled sheet. These cabinets have a door in the front, which can be closed hermetically, by which a rack in alpax or stainless metal is pushed in. On the shelves of this rack the canned or moulded hams are placed. The racks either roll on the floor by rollers, or are suspended from a track in the ceiling.

The lower part of the cabinet is composed of a vat of water in which a steam coil is arranged. Heated by the coil, the water evaporates and the vapour fills the cabinet. Cooking is, therefore, carried out by low pressure dilute steam. Admission of steam to the heating coil is regulated by thermostat, so that by setting this the temperature of cooking can be regulated as desired in advance.

It is also possible to fix the duration of cooking, by means of a time clock which cuts off the heat at the desired time. This possibility of regulating the temperature and the duration of the cooking offers numerous advantages. In the first place cooking proceeds without the need for watching the process; there is no possibility of mistakes, and the personnel can do something else while the hams are cooking. A recording thermometer connected to the apparatus effects the control of the operation.

After cooking, the hams, still on the racks which supported them in the cooking cabinets, are run into another cabinet in which they are cooled under a shower of cold water. Each rack supports from 30 to 50 hams, so that handling is much simplified. The cabinets used are, moreover, neither cumbersome nor difficult to operate nor to keep in repair.

Manufacture of Meat Pies

Many products are also baked, and those engaged in the manufacture of meat pies and similar goods are familiar with coal, gas and electric or oil burning ovens. To avoid coal dust in the shops in which the meats are prepared, ovens with the fire box on a lower floor have been built during the past few years. Sometimes the fire box is placed alongside the oven, and a partition divides the shop to keep the coal handling and meat handling functions in separate rooms. Electric ovens are used in France, but almost exclusively in the smaller factories, where they are much appreciated for their easy regulability, lack of dust and rapid heating up.

A most interesting process, well worthy of mention, used at present in only two or three plants, is the oven heated by high pressure steam. These ovens comprise compartments in brick, externally insulated with cork plates to avoid heat losses through radiation, and have doors in asbestos lined sheet iron. Each compartment is heated by steam coils, fed with superheated steam at between 140 and 170 lb. pressure. The pies to be baked are arranged on racks which can be pushed into the oven, the shelves of the rack being arranged in such a manner as to permit the heating coils to project into them, between each two layers of pies. In this way, heat is applied evenly to each pie, from above and from below.

This system has numerous advantages, provided, of course, a supply of steam at suitable pressure is available. In the first place, there is no handling of the pies, there is no dust, no coal, and there is a perfectly even temperature, easily regulated. Ovens of this type can easily be built for operating temperatures up to 140° C. Contrarily to what might be thought, the pies are not dried out, and bake beautifully brown, as in any other oven.

To facilitate work and save time, a series of racks is provided for each oven, so that while one rack full of pies is baking another can be prepared. As the pies come from the oven, they are taken to a ventilated room for cooking, thence to the despatching room.

Handling Systems

The greatest progress is, perhaps, to be seen in the application of mechanical handling systems. This development is due largely to increased labour costs which rendered the older wheeled trucks, which are heavy, hard to handle, and carry only a small load, uneconomical. Most modern plants have adopted transport by overhead rail systems, designed to serve all the shops. The system is designed to present the necessary curves, crossings and garage tracks. Vertical transport is provided by lifts which are likewise provided with sections of track which can be connected to the overhead system on each floor when the lift stops.

The tracks used are either I-beams or double I-beams held together by cross braces, suitably spaced. The double beam system permits sharper curves and easier switching. Suspended roller bearing overhead trucks run along these tracks, designed for loads up to about 750 kilogrammes—say, 15 cwt.; a variety of racks are used, hooked on to these trucks. For products intended to be smoked, square frames, suspended from a central pivoting hook are used. The cross-pieces of these frames are provided with notches in which bars are fitted, these latter supporting the suspended sausages, hams, bacon, etc. As the overhead track runs past the stuffing tables, the sausages, as soon as they have been stuffed, can be placed on the bars in the racks, one rack holding between four and seven cwt. of sausage.

For smoking hams, a type of carrier which is also used is supported on two sets of rollers running on the overhead rail. A slightly different type of two-wheeled carrier is used for half-pigs. Racks with shelves are also widely used for a variety of articles which require moving.

These mechanical handling devices, which are to be seen developing with great rapidity in recent plants, render very real services, avoid fatigue for the workers, and permit the rapid and easy transport of the goods.

MILK PRODUCTS PLANT AND EQUIPMENT

THERMO-COMPRESSION EVAPORATORS

Thermo-compression has very particular advantages when applied to milk products, as it is impossible to use multiple-effect evaporation, for example, owing to the risk of too high a temperature in the first effect, and too low a temperature in the second effect, when using a double effect plant. As the modern tendency is also to construct plants in stainless steel, the capital cost of a double effect is high.

One of the main objections to a thermo-compression plant is the large heating surface necessary. It is not possible to satisfactorily incorporate thermo-compression in a coil pan, and tubular calandrias are therefore used, and in a fairly large-size plant a standard thermo-compression unit incorporates a very large number of tubes. This is readily understood in considering the principles of thermo-compression.

In an ordinary single-effect evaporator the temperature difference between the steam and the liquor is in the order of about 80° to 90° F., whereas in a thermo-compression plant it will be approximately 30° F. It will be seen, therefore, that for a given quantity of evaporation almost three times the heating surface is required. This means that the pan has to be of large size so as to accommodate the tubes, and consequently the minimum batch size of the plant must be comparatively high.

George Scott and Son (London), Ltd., claim that by incorporating the Scott Patent Forced Circulation system with thermo-compression it is possible to very considerably reduce the heating surface required which brings the unit back to more reasonable size limits, with a consequent reduction in capital cost, etc.

Quite apart from the question of size of plant and capital cost, one of the great advantages of thermo-compression is the steam and water economy to be obtained, this, of course, being a continuous charge against the plant.

It may be said of the thermo-compression evaporators that these require only about 50 per cent. of the steam required in an ordinary evaporator. The lower the temperature difference between the steam and the liquor, the lower the steam consumption, but the heating surface required increases rapidly.

Considering an evaporation of 1,000 gallons of water per hour, this in an ordinary single-effect evaporator with a temperature difference of, say, 85° F., would need approximately 11,000 lbs. of steam. If the temperature difference were 36° F., the steam consumption would be 6,500 lbs., with a temperature difference of 27° F., 5,500 lbs., and 18° F., temperature difference 4,500 lbs. These figures are, of course, approximate, as there are variations according to the pressure of steam supplied to the thermo-compressors.

It is found in practice that the most satisfactory compromise between reasonable steam efficiency and capital cost is to choose a temperature difference of 27° F. This, on the figures above, gives a steam consumption of 50 per cent. less than an ordinary evaporator. The water consumption is also correspondingly reduced.

From the point of view of the temperature conditions for the handling of milk products, thermo-compression is excellent, as the steam temperature is so much lower that there is less risk of overheating the milk. The combination of forced circulation and low-temperature difference makes an ideal plant.

The plant is most particularly applicable to continuous working units for pre-condensation, etc., but can also be suitably adapted for the handling of sweetened condensed milk on batch principles. In this particular case the advantages of steam economy are not so marked, but are certainly to be considered. The steam consumption in general would be about 10 per cent. higher for sweetened products than for ordinary products.

The advantages of the Scott Patent Forced Circulation system with thermo-compression may be summed up as follows :

1. Steam and water requirements are approximately halved.
2. The liquor is processed at ideal temperature, both in the evaporator itself and in the steam-heating medium, which is particularly important in the case of milk products.
3. The batch capacity of the plant is comparatively small, which means that when pre-condensing the following process plants—for example, the drying plant—can be started up more quickly. .
4. The plant is ideal for continuous running over long periods, due to the low temperature conditions on the steam side combined with the high rate of circulation.

CENTRIFUGES IN BUTTER TREATMENT

Conditions at the present time make it necessary for the conservation of as much butter as possible, and it is therefore important that edible butter fat should be recovered from all second-grade and waste butter. The following processes have recently been put forward by Messrs. Alfa-Laval Co., Ltd.

Butters which are unfit for edible purposes may be divided into two classes : (1) Samples which have become damaged by contamination with dirt, water, etc., and (2) samples in which chemical change has resulted in increase of acidity or development of unpleasant taste or smell. Samples of type (1) will, of course, quickly develop into type (2) unless treated quickly.

In the treatment of contaminated samples the butter is first melted and heated to 60° C., a small proportion of hot water is then mixed with it and the whole run through a De Laval Centrifuge. The rotating bowl of this separator is designed so that a continuous separation of the water, dirt, casein, etc., from the fat is obtained. The separated fat is entirely free from impurities and contains not more than 0·1 per cent. moisture. The solids are discharged from the separator together with the water and so frequent cleaning of the bowl is not necessary. The separated fat is entirely suitable for use as such, or for reconstituting into butter.

If the butter has developed acidity or unpleasant taste or smell, further treatment is necessary. Fat is first obtained by the above method. The fat is then re-heated and sufficient caustic soda to neutralise the acidity carefully stirred in. When the soap which is so formed has coagulated into compact particles, the mixture is run through the De Laval Separator again. The soap is separated from the fat and discharged continuously from the centrifuge. The separated fat is neutral and free from soap.

It is probable that the fat will still have a slightly strong smell, and in order to remove this the fat should be given a "positive water wash". This is an effective washing method which can only be carried out efficiently in the conical disc-type bowl with which the De Laval is fitted. The hot fat is run through the centrifuge, together with a stream of hot water. Special disc assembly in the bowl causes the fat and water first to be broken up into very fine particles, giving an excellent washing, and then the separation takes place. The hot water in this operation removes practically all the odour, and the separated fat is fresh and has a pleasant flavour. The fat may then be reconstituted or used as fat.

It has been shown that samples of butter fat so treated by the above methods can be stored for long periods without cold storage and yet show no appreciable signs of deterioration. Samples of fat separated as described for type (1), but from fresh butter, have been stored for over a year, under ordinary conditions, without showing any appreciable increase in acidity.

In view of the restriction of cold storage space available at present, the possibility of storing fat so obtained, and reconstituting it as required, is well worth considering.

PROTECTIVE WEAR FOR MILKERS

The problem of conceiving and producing an ideal garment for the hand milker has received long and intimate study by Messrs. John Peck and Co., Ltd.

Their principle of designing all garments on anatomical lines according to the particular requirements of the actual wearers in various trades was taxed by the problem of providing the milker with adequate protection in the sitting position, and allowing sufficient "play" in the garment to ensure the avoidance of any grip or pinch in movement. Arms also have to be quite free and unhampered, and—very important still—the garment had to be simple to adjust and remove.

Many designs were tried, some of which were more or less satisfactory, and finally the "Pexmilka" was produced. This is an overall coat-apron, is quickly put on, and does not impede movement during milking. There is adequate coverage of the knees whilst the pail is in position, and there are two ample pockets. The material is strong unbleached drill or, alternatively, twill, both of which withstand rigorous washings. Thus the garment conforms to the strict hygiene requirements of to-day.

CHEESE MELTING SALTS

Processed cheese manufacturers, both here and abroad, will be interested to learn that the well-known P.X. Cheese Melting Salts are now being marketed by Henry A. Lane and Co., Ltd.

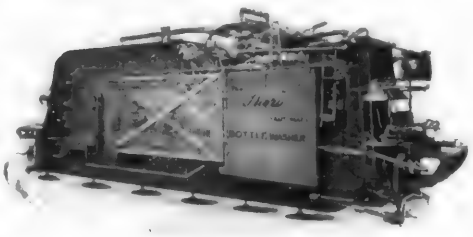
P.X. Salts are manufactured by a patented process which produces a blend of citrates and phosphates, the finished salts appearing as fine white powders, completely homogeneous and easily soluble in water.

The exact composition of P.X. Salts has been arrived at by years of experiment and research in the problems connected with cheese processing (both spread and Cheddar types), with special reference to such factors as oil separation, *p*H value and acidity, and keeping qualities. Features claimed for these melting salts are :

1. Powerful emulsifying action.
2. Preservation of the natural Cheddar flavour in the processed product.
3. Accurate control of *p*H value in the processed cheese facilitated by reason of the powerful buffer action of the citrate-phosphate combination.
4. The salts are ready for immediate use, and, owing to their high solubility and fine state of division, can be added to the cheese either in solution or in the dry state.
5. The salts can be stored indefinitely in ordinary containers without deterioration of their properties.

The variety of P.X. Salts which can be manufactured is very large, and it is the manufacturers' policy to study the needs of the individual customer, special melting salts being prepared where required, although in practice it has been found that requirements can nearly always be adequately met by one of three popular grades.

BOTTLE WASHING



Automatic bottle - washing machines having some very useful features are made in sizes to suit any bottle from an imperial quart down to a 4-oz. jar, having capacities from 24 to 200 bottles or jars per minute. The four- or five-compartment washer is fitted with a hand-fed accumulative loader. This type of loader is used where it is convenient to bring the cases containing the empty bottles to the washer.

After prolonged soaking they are subjected to double inside and outside brushing, followed by several rinsings with fresh water, after which the bottles are drained and automatically discharged on to a bottle conveyor, which carries them either to an accumulator table or direct to the filling machine.

Some washers are supplied without brushes, in which case a series of rinsings with hot detergent are given.

These machines, although mainly used by bottlers of milk, beer, mineral water and other liquids where large quantity output is required, are useful to manufacturers of sauces, coffee extract and other food products. They are manufactured by R. W. Webster and Co., Ltd.

CORRESPONDENCE

H. Horace Ward writes about Fortified White Flour

The Editor.

DEAR SIR,

I thank you for the opportunity of adding my opinion to those of other cereal chemists as published recently in your Journal, and I think it would be useful to review the Symposium on Fortified White Flour, published in September.

It appears to be agreed that the addition of vitamin B_1 to white flour will be of general benefit. This opinion was to be expected from cereal chemists, who have for many years been aware that the presence of vitamin B_1 provided a powerful argument in favour of brown bread. Flour would appear to be an excellent vehicle in which to make up a deficiency. The quantity of added vitamin can be controlled; the amount required varies with the carbohydrate intake and, again, bread is mostly associated with fatty foods such as butter and margarine, which will supply other vitamins.

Mr. Bacharach suggested that the quantity of vitamin to be added is on the low side. It should, however, be remembered that the deficiency is greatest amongst people with the lowest incomes, who consume relatively greater quantities of bread than those at higher income levels. The addition to flour ensures that the section of the population most in need will receive the largest dose. According to statistics collected by Drs. Moran and Booth, the suggested addition should provide a good average intake.

There has been far more disagreement regarding the proposed addition of calcium salts. Calcium carbonate has been in use in mineral mixtures for animal feeding for years, and there is no question of the beneficial effects of the practice.

Again, flour appears to be an excellent medium for making up a natural deficiency due to its association with butter and margarine. Mr. Bacharach rightly suggests that the addition of substances such as calcium will establish a precedent, and control must be exercised to avoid subsequent indiscriminate additions.

The prevalence of rickets, caries and the more homely chilblains suggests a deficiency of calcium, and there is little doubt that the calcium-phosphorus ratio of the average diet is not correct. Even wholemeal bread is incapable of correcting this ratio, while under present conditions milk, cheese, and green vegetables are in grave danger of being in short supply in some districts at least.

Considerable care will be necessary in choosing the correct calcium salt. Whilst the carbonate has been used successfully in animal feeding, it was pointed out that by lowering the *p*H of the dough certain adverse baking results may be evident. Milk salts or calcium lactate might provide suitable forms, but may be ruled out on the question of cost.

A good deal of importance has been attached to the analytical control of these new additions, and undoubtedly this is a matter for some concern from the purely practical point of view. Aneurin is costly and must not be wasted, although there is little fear of over-dosing the public, since even the ten to twenty times mentioned by Mr. Bennion would not have any serious effect, particularly as it is certain not to happen very often.

Production will probably be greater than actual requirements, and since interest has already been aroused, it is possible that a ready market will be found for surplus aneurin in Ireland and other countries where the addition is not yet compulsory. This should reduce costs, as production costs will fall rapidly with increased output.

Some analytical control will, of course, be essential, and, as suggested by Dr. Kent Jones, collaborative work should be undertaken speedily, at any rate on the estimation of vitamin B_1. The calcium addition should present no difficulty.

The present seems to be a suitable time to introduce the changes. Many snack meals have to be taken, and bread will therefore be consumed in rather larger quantities than in peacetime. From this point of view, the increased consumption of vitamin B_1 may be a very considerable aid in preventing nervous and digestive troubles at a critical period. Two of your correspondents share this opinion, anticipating an increase in B_1 deficiency under war conditions.

It is to be hoped that the additions will not cause the public to feel that the natural protective foods are not necessary. We all have much to learn, and the education of the public should be continued so that the consumption of protective foods such as milk, cheese, green vegetables, etc., will be encouraged. Let these and similar expedients be used to overcome some of the deficiencies of our present-day mode of living, but let us continue with the work of learning more of these difficult problems.

The benefit of the proposed changes may not be apparent for some time, but, despite the difficulties, every effort should be made to assess their influence on the health of the nation.

H. HORACE WARD,

Analytical and Technical Laboratories, Aynsome, Grange-over-Sands, Lancs.

NEWS FROM THE INDUSTRY

Welsh Tinplate Industry

The Welsh tinplate industry has operated since the outbreak of war at quite satisfactory levels, limited only by the diversion of steel supplies to other purposes and by the difficulty in obtaining permits for the purchase of tinplate.

Priority is given to consumers whose output is of direct national importance, and it should be noted that food canning comes into this category. The packs of fruit and vegetables in the United Kingdom will be far larger this year than in any previous years.

For the time being alternative packages will have to be used for these commodities for which the use of tinplate is now prohibited, but it can be predicted with confidence that these markets will be regained as soon as normal conditions are restored.

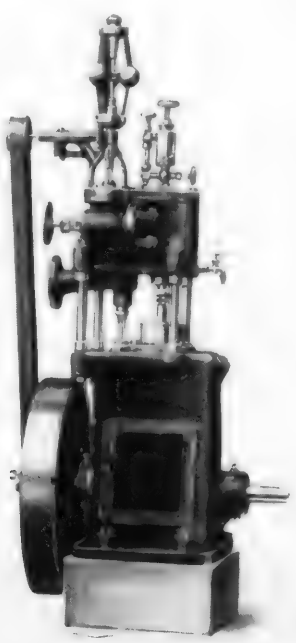
It has been pointed out that in 1918 cardboard cartons and other alternatives which replaced tinplate to a large extent caused no permanent disadvantage to the tinplate industry. This is proved by the fact that the world's production of tinplate has increased from 1,750,000 tons in 1913 to over 4,000,000 tons yearly now.

* * *

Stand-by Steam Engines

A full description of a high-speed double-acting single-cylinder steam engine is given in a leaflet issued by F. W. Brackett and Co. Ltd. These small steam engines are being used for stand-by drives in several food factories. The leaflet in question gives the full specification.

The firm also manufactures a full range of pumps, wet and dry vacuum pumps, and air compressors.



Standards for Dairy Materials

The British Standards Institution is preparing specifications for various materials used in the dairy industry, and representatives of the British Dairy Farmers' Association are members of the various committees entrusted with the preparation of these specifications.

Draft tentative specifications have been, or are being, prepared on the following subjects and will be published in due course:

1. Sampling and analyses of casein.
2. Cheese cloth, butter muslin, filter cloths and pads.
3. Parchment for the wrapping of dairy produce.
4. Microbiological examination of butter.
5. Rennet, annatto and other colours used for dairy purposes.
6. Salt for dairy purposes.
7. Coated tin foil for use in the dairy industry.

* * *

New Creamery

A Scottish creamery, which for many years was operated by United Creameries Ltd. as a margarine factory, and later by Unilever Ltd., and which has been closed since about 1925, has been purchased by Nestle's Milk Products Ltd., London, who have entered into an agreement with the Scottish Milk Marketing Board for a supply of milk for the manufacture of condensed milk and milk powder.

The present buildings, though commodious, will require some alteration for the new classes of manufacture, and it is understood that the necessary reconstruction work was commenced early in September to permit of completion by March, 1941, when Nestle's hope to begin operations.

This new development should provide a useful outlet for local labour, and it is estimated that the services of approximately 150 employees will be required.

* * *

Food Prices

September witnessed a further small increase of 0·8 per cent. in British wholesale prices. *The Financial Times* index number at the end of the month was 134·3 (1938=100), compared with 133·4 at the end of August.

The September price increase was mainly in foods, which rose on the average by 3·0 per cent. Grain prices were firmer, and potatoes and cheese were dearer. There was also the usual seasonal increase in the price of eggs.

The total increase in wholesale prices since the outbreak of war is 39·7 per cent. There is little divergence between the war increase in food and raw material prices.

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Society of Chemical Industry

The Society has announced that until further notice all communications should be addressed to the General Secretary, Editors, and Advertisement Manager, Society of Chemical Industry, Imperial College of Science, Prince Consort Road, London, S.W. 2.

Jacket Construction

Two up-to-date methods of jacket construction which are applicable to almost all the materials used in the construction of modern food-manufacturing equipment are known as the "Dimple" type, and the other the "Coil" type.

The manufacturers, Henry Balfour and Co. Ltd., claim that these methods permit the fabricator to reduce the weight of material to a minimum for a specified duty, and assist the food manufacturer's engineer to reduce his maintenance costs.

* * *

Government Cocoa Purchase

The Colonial Office announces that arrangements have been made for the purchase by the United Kingdom Government of the whole of the coming cocoa crops in the Gold Coast and Nigeria.

The general scheme of control which operated last season will continue with certain modifications. In particular, the fixed price paid to the growers will be reduced by approximately 20 per cent., in view of the further restriction of markets which has resulted from the spread of the war in Europe. A West African cocoa control board is being set up to administer the scheme. The constitution of the board will be announced shortly, purchasing in the Gold Coast and Nigeria began on October 1.

* * *

Confectionery Business Wanted

Should any readers know of a business at present engaged in the manufacture of confectionery and foodstuffs which is for sale at the present time, they are informed that there is a firm interested in its purchase, and we should be pleased to establish the necessary contact.

Smith's Crisps Interim

The directors of Smith's Potato Crisps have declared an interim dividend of 7½ per cent., less tax, payable October 12. This distribution is at the same rate as for the preceding year, when a final dividend of 20 per cent., together with a cash bonus of 5 per cent., both less tax, was paid.

Issued capital is £376,228. The 5s. shares were dealt in at 23s. 4½d.

* * *

Dried Milk for Infants

Supplies of dried milk for Scottish infants under one year were available from about the third week in August, announced Mr. Ernest Brown, M.P., Secretary of State for Scotland, in a circular issued by the Department of Health for Scotland. For the purpose of the scheme a single type of milk powder, to be known as National Dried Milk, will be available. The milk, a full-cream powder, will be issued in packets of 20 oz.—equivalent to 1 pint per day for a week—at a cost of 1s. 2d. per packet, or free, according to income. Standard measures will be supplied for use in preparing feeds, and in each packet will be a table of directions.

* * *

National Canning

Record profits are reported by the National Canning Co., Ltd. After taxation, net profit for the year to May 31 last amounted to £53,534, according to a preliminary statement issued recently. In the previous year there was a net profit of £43,424.

The directors recommend a dividend of 7½ per cent. and a bonus of 2½ per cent. on the 350,000 old Ordinary shares of £1, and a dividend and bonus on 75,000 new Ordinary shares at the above rates for six months only—*i.e.*, half the amount payable on the old Ordinary capital. The dividend for the previous year was also 7½ per cent., but the bonus was only 1 per cent.

From the year's profits it is proposed to place £15,000 to the reserve and to carry forward the balance of £41,761. The previous year's carry-forward of £28,759 was after transferring £15,000 to reserve.

* * *

Carton Makers Lead in Spitfire Fund

A Spitfire fund has been opened in Newbury with a cheque for £1,000 subscribed by Cropper and Co., Ltd., Colthrop Board and Paper Mills, Ltd., and Containers, Ltd.

An interesting part of the scheme in this area is the formation of a committee of ladies whose Christian names begin with letters forming the word "Spitfire".

* * *

Spillers' Central Laboratories

Correspondence which would normally be addressed to Spillers' Central Laboratories, or to Dr. Green at Victoria Docks, E.16, should, for the time being, be sent to 40, St. Mary Axe, E.C.3 (*Tel.:* AVEnue 7500).

Owing to the loss of correspondence and other information, it is hoped that correspondents will appreciate the circumstances if they do not receive replies to any outstanding letters.

Mr. W. Leonard Hill

Mr. W. Leonard Hill has been elected a member of the Council of the Advertising Association.

* * *

Apple Juice in Canada

Of the 1,500,000 gallons of apple juice produced in Canada last year, about half came from the three plants operating in Nova Scotia.

* * *

Tea for Workers

The Ministry of Food has extended for a further period the arrangements by which groups of industrial, business and clerical workers can obtain tea for consumption during their working hours.

Current retailers' permits for the supply of tea for this purpose, many of which are about to expire, can be regarded as extended for a further period of eight weeks. There is no need for applications for renewal of the permits to be made for the time being to local food offices.

* * *

Horlicks, Ltd.

Among the matters mentioned by Lieut.-Colonel J. N. Horlick, O.B.E., M.C., chairman of Horlicks, Ltd., speaking at the fourth annual general meeting of the company recently, were: the Belgian company, the situation in respect of which was necessarily very obscure and must remain so for the present. It has been thought prudent, therefore, to make full provision in the accounts for the possibility of the assets of the Belgian Company becoming a total loss—fortunately only a small matter. With regard to other subsidiaries, Horlicks' new factory in New Zealand commenced production some two months ago.

The chairman drew attention to the stocks on hand, which, in pursuance of the Board's policy of building up reserves throughout the country to meet any emergency that may arise, have been substantially increased in the last two years. These stocks are strategically distributed, and the company are working in close collaboration with every food controller.

The resolution was proposed and carried that a final dividend of 16⅝ per cent. actual, less income-tax of 8s. 6d. in the pound for the year ended March 31, 1940, be paid to stockholders registered on the books of the company as at September 25, 1940.

* * *

Benevolent Fund Appeal

The Manufacturing Confectioners Commercial Travellers' Association, in a letter to its members, have issued a special appeal on behalf of its benevolent fund. The Association points out that many sources of revenue have been cut off during the past twelve months. At the Firms Representatives' Conference, the Annual Dinner, and other functions collections were made on behalf of the fund, and it is estimated that a loss of approximately £60 is involved as a result of the abandonment of these meetings.

OBITUARY

Sir Robert A. Hadfield, F.R.S.

We regret to announce the death of Sir Robert A. Hadfield, F.R.S., the eminent metallurgist; he died on September 30 in London at the age of 81. An obituary notice of him will appear in a later issue.

* * *

Mr. W. J. Alcock

It is with regret that we learn of the death of Mr. W. J. Alcock of Calcutta.

Mr. Alcock, who was a member of the Institution of Chemical Engineers, has for very many years been perhaps the best known consulting chemical engineer in India. He was responsible for much the greater part of the sugar installations in India.

Mr. W. Leonard Hill writes: "Our personal recollections of the late Mr. and Mrs. Alcock and of his son and daughter, who remain in Calcutta, are of the pleasantest. The hospitality extended to us on our last visit was generous and helpful."

* * *

Mr. M. Perry

We regret to learn of the death of Mr. M. Perry, for many years connected with chemical engineering. He was later associated with Albro Fillers and Eng. Co., Ltd.

* * *

Mr. Andrew W. Farquhar

Mr. Andrew W. Farquhar, a well-known figure in the grain trade in Scotland, has died at his residence, Hermiston, Bridge of Weir, at the age of 72. For more than 40 years he was associated with Farquhar Brothers, flour merchants of Glasgow, and took an active interest in the affairs of the Glasgow Corn Trade Association, until his retirement from active business ten years ago.

Mr. Farquhar is survived by his wife, one daughter and two sons, one of whom is Wing-Commander A. D. Farquhar, the Glasgow stockbroker, who accounted for the first enemy bomber to fall on British soil. He was decorated with the D.F.C. by the King.

Peppermint Oils

Reports from America indicate that the crop is likely to be a fairly normal one this year, and the price of oil from this source is reasonably steady at the moment.

It is difficult to anticipate the price of the peppermint oils; on the one hand is the fact that no American oil will be shipped to the Continent this season, which will indicate that there will be a surplus, but on the other hand the U.S.A. was a considerable importer of Russian and Bulgarian oils, which in turn are cut off this season from America.

Stocks of this and other oils may be obtained from Stafford Allen and Sons, Ltd.

INFORMATION AND ADVICE

Drying Beef Suet — Sage — Jam Regulations — Artificial Cream — Keeping Canned Goods — Information Supplied

Drying Beef Suet

6,566. *I would be very much pleased if you could advise me of a process whereby I may dry beef suet before mincing. I am aware that ground rice is used, but this is generally after it has been minced.*

The drying of beef suet before mincing can only be done by rendering, whereby the moisture separates out. However, this requires steam-jacketed pans, etc., and it would probably not be worth your while, unless you are producing on a large scale.

You mention ground rice, but the function of this is not to dry the suet, but mainly to prevent the conglomeration of the minced fat.

If your product is one which is consumed within 14 days of being prepared, we suggest the following procedure:

The suet should be perfectly fresh, all adhering skin, blood, etc., being removed. The suet should then be cut in ¼-inch cubes in a *bowl chopper*, and then spread out well and put into a refrigerator overnight.

The next day the suet should be cut finer in the bowl chopper. Unless there is any regulation against it, or there is some other reason against its use, the addition of a small proportion of rice powder improves the appearance and texture of the product. According to the Food and Drugs Act in this country, it is necessary to declare on the label that such an addition of rice powder has been made.

Should the product not be likely to be consumed for a time exceeding 14 days, it is not safe to use untreated suet, as it will go rancid.

You will note that we have advised that a bowl chopper be used for mincing, as the use of a mincing machine would convert the suet into a doughy mass.

If you were contemplating rendering the fat, you would get some valuable information from the article on Premier Jus manufacture, by T. Crosbie-Walsh, F.I.C., published in the February 23 issue of the weekly edition of *Food Manufacture*.

Sage

6,541. *We are growing our own sage, but we do not know the best way to treat it when it is ready for use.*

Are the leaves picked separately, dried and then rubbed, or is it ground by any machinery? If you can give us any details, we shall be pleased.

The following is an extract from an article on "Sage" by H. Stanley Redgrove, published in FOOD MANUFACTURE:

> "When required for drying, the leaves should be harvested when the flowers are about to appear. The quality of the product depends very much upon the care with which the leaves are dried. Too high a temperature causes the dissipation of the essential oil to which their flavour is due. Up-to-date drying sheds are quite essential for the production of first-class dried sage on a commercial scale.
>
> "Grinding is also a matter of importance, and the views of prospective purchasers should be consulted as to the degree of fineness preferred."

The stems, of course, should be avoided and only the leaves used. Rubbing, as opposed to grinding, is only suitable when a coarse product is required.

With regard to drying and grinding, no doubt the manufacturers of such plant would be able to advise you as to the best type to use. (Names of firms given.)

Jam Regulations

6,520. *We would be very much obliged if you would supply us with regulations and agreements governing the sale of jam in Great Britain, also if there are any temporary regulations in force owing to the war.*

With reference to the composition of jam, there have been no modifications up to date, and you will get the existing ones in "Food and Drugs Act—Preservatives, etc., in Food Regulations", obtainable from H.M. Stationery Office, under S.R. and O. 125, No. 775, as amended by 1926, No. 1,557, and 1927, No. 577.

Up to the time of going to press also there have been promulgated no regulations as to price, but we are informed that this is being considered by the Ministry of Food.

Artificial Cream

6,664. *We are interested in the possibility of the production of synthetic cream, and we shall be glad of any information you can give us with regard to this.*

The following extract from a patent may be of assistance to you:

Artificial cream and other emulsions rich in fat are made by using as protective colloids concentrated protein solutions of other phospho-proteins to which may be added dissolved proteins, preferably globulins and albumen. The oil or fat is added gradually, with stirring, to the protein solution, and the mixing, which is effected by simple stirring, may be at a temperature at which the fat is liquid. With some kinds of emulsifying machines, the mixture may be effected at below the melting-point of the fat. A fat having the desired melting-point may be prepared by melting together oils and hard fats which may be obtained by hardening oils.

In making artificial cream, for instance, arachis oils and hard fat are mixed to give a product having the melting-point of milk fat, and this mixture may be sterilised before use by heating at 100° C. The fat is added at above 30° C., preferably at 40° C., to milk evaporated preferably under vacuum at 50° to 60° C. and containing 50 to 70 per cent. of solids. Milk or water is added during the addition of the fat to keep the mixture at a suitable consistency. After thorough stirring the mixture is homogenised while hot.

Keeping Canned Goods

6,662. *We shall be glad to receive some information from you in connection with the keeping qualities of canned goods: how long the different varieties of canned goods can be kept; the necessary conditions; whether or not movement of the tins lessens the keeping qualities, etc.*

Canned fruits and vegetables tend to deteriorate in colour and consistency after a year or so, but canned meat and fish improve with keeping and are excellent after two or three years in the tin.

Cool conditions of storage are favourable, and humidity is to be avoided purely on account of the possibility of rusting the tins.

With regard to your query about movement, this should obviously be avoided in the case of any but solid packs, as soft fruits, vegetables, etc., would tend to disintegrate by shaking, thereby affecting their commercial value.

Information Supplied

6,474. *We shall be obliged if you will send us the address of the firm mentioned in the June issue of* FOOD MANUFACTURE *as having introduced Van-B-Ness Liquid Vanilla flavour.*

Address given.

6,468. *I am anxious to learn of possible sources from which I could obtain supplies of milk sugar, and would be very much obliged if it would be possible for you to furnish me with some addresses.*

Addresses supplied.

6,533. *We shall be glad to know whether you can put us in touch with any makers or suppliers of a Transwrap machine.*

We are interested in a machine for small packages containing an ounce of powder.

Names of suppliers given.

RECENT PATENTS

These particulars of new patents of interest to readers have been selected from the "Official Journal of Patents", and are published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

Abstracts of Recent Specifications

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume, or in bound volumes price 2s. each.

Improvements in Low-temperature Processes for the Preservation of Perishable Foodstuffs

A process for preserving perishable foodstuffs which consists in introducing liquid carbon-dioxide into a vessel containing the foodstuffs, allowing it to vaporise and expand within the vessel, whereby its temperature falls, permitting the continuous escape of gas from the vessel, whereby the gas flows through the vessel, recovering the carbon-dioxide gas from the vessel, compressing it to reliquefy it and using it over again. The liquid carbon-dioxide is cooled on its way to the vessel by the carbon-dioxide gas discharged from the vessel. The temperature of the gas within the vessel is controlled by controlling the rate at which the carbon-dioxide is admitted to and discharged from the vessel.

The foodstuffs are first cooled to a comparatively high temperature, such as 0° F., and are then immediately or gradually cooled to a much lower temperature, such as −70° F.

The carbon-dioxide gas is caused to flow through the vessel at a high velocity, whereby the heat is extracted from the foodstuffs with great rapidity.

A preliminary treatment consists in drenching the foodstuffs with water, brine, or other solution.

Apparatus for carrying out the process, comprising a freezing vessel containing the foodstuffs to be treated, means for admitting liquid carbon-dioxide to the interior of the vessel, and a controllable discharge-valve for continuously discharging the gaseous carbon-dioxide, means for recovering, recompressing and liquefying the carbon-dioxide and returning it to the vessel and heat-exchange apparatus whereby the liquid on its way to the vessel is cooled by the gas leaving the vessel.

The said discharge-valve is held closed by a spring, of which the pressure is adjustable, and there are means for purifying and drying the gas discharged from the vessel before it is returned in the form of liquid to the vessel.

Apparatus comprising, in addition, a gas-holder to which gas is discharged from the vessel when the pressure in the vessel has been reduced to the pressure on the intake side of the compressor, and apparatus comprising a booster-pump for restoring the pressure of the gas in the gas-holder to the pressure on the intake side of the compressor, and an interconnection between the means for driving the booster and the gas-holder such that the booster is automatically driven at a speed corresponding to the volume of gas contained in the gas-holder. Also apparatus wherein the vessel comprises a lagged metal cylinder having a removable cover, and apparatus wherein the vessel comprises a lagged metal cylinder open at the bottom and a platform for supporting the goods to be treated and adapted to be pressed up into engagement with the open bottom end of the cylinder. The said platform constitutes the head of a hydraulic press.

An article of food when treated by the process claimed. Also a process of preserving flesh foods, which consists in subjecting them to the process claimed while the phagocytic action of the amœbulæ of the blood and lymph is still operative.

An article of flesh food when treated by a process as claimed.

Apparatus for carrying out the herein described method of preserving perishable foodstuffs, substantially described.

521,715. Walter Scott Josephson (Senior) and Walter Scott Josephson (Junior).

Improvements in the Bacterial Fermentation of Carbohydrates

The improvement in or modification of the process of specification No. 453,524, which consists in inverting a disaccharide capable of inversion by means of invertase and effecting fermentation by means of *B. tetryl*.

A process in which the *p*H of the sugar solution is adjusted to 5·7 to 6·0 before treatment.

Autolysed yeast is employed to invert the sugar, and a material containing ordinary yeast and a volatile antiseptic is autolysed and added to a disaccharide solution capable of inversion.

A process is claimed in which molasses or a sterile molasses mash is treated.

A process is claimed in which the inversion and fermentation are allowed to proceed concurrently, and also in which the *p*H of the sugar solution is adjusted to 5·5 to 6 before treatment. Also in which distillation slops are added to the molasses during fermentation.

The density of a mixture of autolysed yeast, sugar mash, and organism is initially adjusted so as to be 9 to 11 Brix, and it is fermented for 18 to 24 hours, an equivalent volume of sterilised distilleries slop, the *p*H of which has been adjusted by calcium carbonate is then added, and the fermentation allowed to proceed.

A process is claimed in which the sugar is inverted at a greater concentration than that employed in fermentation, and also a process of producing butanol and acetone as particularly described.

521,849. Harold Edwin Potts, for the Lummus Company, U.S.A.

Latest Patent Applications

12362. SUTCLIFFE, J. W., and SUTCLIFFE, T. C.: Bottling and preserving fruits, etc. July 31.

10950. BRITISH CELLOPHANE, LTD.: Protection of goods and persons from toxic liquids. June 27.

11128. POKORNY, E. A.: Food preservation. July 2.

11111. UNIPEKTIN AKT.-GES.: Method and apparatus for the fermentationless conservation of fruit, etc. July 1.

10766. SMITH, A. H., and DENCE, C. S.: Machines for filling containers with pastes, creams, etc. June 22.

10642. STEVENS, A. H. (MECHANICAL RESEARCH, INC.): Methods and apparatus for freezing food products. June 20.

13437. ELDORADO ICE-CREAM CO., LTD., and FAVIER, C. P.: Machinery employed in the manufacture of ice-cream. August 24.

13321. EWART R. D.: Vegetable-peeling machines. August 22.

13332. FREY, W. J. A.: Preparation of yeast for bread, etc., making. August 22.

Specifications Published

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

523,779. SEABROOK, J. A. E.: Storage of foodstuffs.

524,022. LANCASHIRE DYNAMO AND CRYPTO, LTD., and WILSON, E. P.: Filling machines, more particularly for sausages.

523,946. JOSEPHSON, SEN., W. S., and JOSEPHSON, JUN., W. S.: Low-temperature processes for the preservation of perishable foodstuffs. (Divided out of 521,715.)

522,817. PEEK, FREAN, AND CO., LTD., and ROBERTS, L. E. H.: Cleaning of cocoa beans.

522,460. DEWEY AND ALMY, LTD. (DEWEY AND ALMY CHEMICAL CO.): Packaging of materials, particularly perishable foodstuffs.

520,916. WALKER, W.: Containers suitable for retail distribution of perishable foodstuffs.

TRADE MARKS

The list of trade marks of interest to readers has been selected from the "Official Trade Marks Journal" and is published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

KINGSWAY.—611,369.—Cream and condensed milk. **Minsterley Creamer[illegible], Ltd.,** 3, Nova Scotia Street, Birmingham 4; and Minsterley, Shropshire. July 3.

Registration of this trade mark shall give no right to the exclusive use either separately or together of the word "Kingsway" and a device of a pastoral scene.

In use upon condensed milk the mark will be varied by the substitution of the words "Condensed Milk" for the words "Pure English Cream."

SPOTLIGHT.—611,627.—Chocolate biscuits. **Gray, Dunn and Co., Ltd.,** 75, Stanley Street, Kinning Park, Glasgow, S. 1. (By Consent.) July 3.

SPOTLIGHT.—611,641—Flour. **The Riverside Milling Co., Ltd.,** 1, Springfield Street, Glasgow. (By Consent.) July 3.

ST. MICHAEL.—611,415.—Margarine. **Auguste Pellerin, Ltd.,** "Le Dansk" Factory, Northam, Southampton. July 3.

VICOLO.—611,578.—Margarine and edible oils and fats. **Victoria Margarine Works, Ltd.,** 99-101, Farnham Road, Slough, Buckinghamshire. July 3.

NEW COMPANIES

Animal Feeding Stuffs C.I.F. Buyers' Association of London, Ltd. (362468.) To carry out duties and powers conferred by the Ministry of Food. Committee (other than Government nominee): E. H. Cowell, H. M. Munro (nominated by John Burstall and Co., Ltd.), and nominees of R. Silcocks and Sons, Ltd.; Joseph Rank, Ltd.; Wallis, Sons and Wells, Fred Sadler, J. and J. Cunningham (London), Ltd., and Union Oil and Cake Mills, Ltd.

Accrington Abattoirs Wholesalers, Ltd. (362640.) Contractors to the Ministry of Food for the slaughtering and handling of cattle, etc. £200. Dirs.: J. Singleton, 35, Kingsway, Ansdell, Lytham St. Annes; J. W. Chadwick, 304, Burnley Road, Accrington; T. Slinger, Clavadel, Livingstone Road, Accrington; T. Riley, 50, Willows Lane, Accrington.

Composite Foods, Ltd. (362859.) Manufacturers of and dealers in concentrated foods of all kinds, etc. £100. Dirs.: B. N. C. Moss, 601, Hawkins House, Dolphin Square, S.W.; F. Abdela, 110, Grove Hall Court, N.W. 8; V. B. Weston and Mrs. S. B. Weston, addresses not stated.

Taken from the Daily Register, compiled by Jordan and Sons, Limited, Company Registration Agents, 116, Chancery Lane, London, W.C. 2.